DRAFT
July 24, 2013

Draft Final Stream Mitigation Plan

Long Branch Stream Mitigation Site

PERMITTEE: South Carolina Department of Transportation

SUBMITTED TO:
U.S. Environmental Protection Agency, Region 4
U.S. Army Corps of Engineers, Charleston District
U.S. Fish & Wildlife Service, Charleston Ecological Services
National Oceanic & Atmospheric Administration, National Marine Fisheries Service
South Carolina Department of Health & Environmental Control
South Carolina Department of Natural Resources

Baker
The LPA Group Incorporated, A Unit of Michael Baker Corporation, 700 Huger Street, Columbia, SC 29201

Draft Final Stream Mitigation Plan
Long Branch Stream Mitigation Site

July 25, 2013

PERMITTEE: South Carolina Department of Transportation

SAC 2008-1333-DIS

SUBMITTED TO:
U.S. Army Corps of Engineers, Charleston District
U.S. Environmental Protection Agency, Region 4
U.S. Fish and Wildlife Service, Charleston Ecological Services
National Oceanic and Atmospheric Administration, National Marine Fisheries Service
U.S. Department of Agriculture, Natural Resource Conservation Service
South Carolina Department of Natural Resources
South Carolina Department of Health and Environmental Control

PREPARED BY:
The LPA Group Incorporated
A Unit of Michael Baker Corporation
700 Huger Street
Columbia, SC 29201

This page intentionally left blank

TABLE OF CONTENTS

List of Tables

Appendix 1. Figures

Appendix 2. I-73 Stream Mitigation Worksheets

Appendix 3. Cultural Resources

Appendix 4. Model Conservation Easement

Appendix 5. Long Branch Survey Data

Appendix 6. Representative Plant Species List

Appendix 7. Reference Reach Photographs

Appendix 8. Site Mitigation Credit Sheets

Appendix 9. Existing Conditions Photographic Log

Appendix 10. References

1.0 PROJECT DESCRIPTION

The South Carolina Department of Transportation (SC DOT), in association with the Federal Highway Administration (FHWA), proposes to construct Interstate 73 (I-73) on new alignment in eastern South Ca rolina. The project alignment shown in Figure 1, begins at the North Carolina state line and extends southeast through Marlboro, Dillon, and Marion Counties, before inter secting with S.C. Route 22 in Horry County. The I- 73 project study area is bounded to the northeast by t he North Carolina/South Carolina state line, to the southeast by U.S. Route 17, and to the southwest by the easte rn edge of the Great Pee Dee River floodplain, U.S. Route 378, and U.S. Route 501. The potential effects of the project were reviewed in two Environmental Impa ct Statements (EISs), one covering the area from the N orth Carolina/South Carolina State line to I-95, an d the other from south of I-95 to U.S. 17. The documents were prepared in collaboration with cooperating st ate and federal agencies including National Oceanic and Atm ospheric Administration (NOAA), South Carolina Department of Natural Resources (SCDNR), Natural Resources Conservation Service (NRCS), S.C. Department of Archives and History (SCDAH), S.C. Department of Health and Environmental Control (SCDHEC), S.C. Department of Commerce (SCDOC), S.C. Department of Parks, Recreation and Tourism (SCPRT), U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), and U.S. Environmental Protection Agency (USEPA). This working group is referred to as the Agency Coordination Team (ACT).

Although two EIS documents were prepared for the pr oject, it was decided that a single Section 404 per mit would be sought for the entire length of I-73 in So uth Carolina. The South Carolina portion of the pr oject is located within three Pee Dee sub-basins: Middle Pee Dee, Little Pee Dee, and Waccamaw (United States Geologic Service [USGS] Hydrologic Unit Codes (HUC) 03040201, 03040204, and 03040206, respectively) in South Carolina. A detailed project description for the I-73 project , including all proposed alternatives, can be found in the Final Environmental Impact Statement (FEIS) located on the SCDOT website (http://www.i73insc.com/default.shtml).

As prescribed in Section 404(b)(1) Guidelines of th e Clean Water Act (40 CFR 230), SCDOT provided deta ils regarding avoidance and minimization measures to li mit direct impacts, including evaluation of alterna tives, in the Chapter 2 of the FEISs and in the permit applic ation. Avoidance and minimization measures incorpo rated into the design include the use of 2:1 fill slopes where practicable to reduce the impact footprint, t he use of bridges rather than box culverts at some higher qua lity wetlands and streams, and a commitment to usin g best management practices (BMPs) during construction to avoid non-permitted impacts to adjacent wetlands an d streams. However, direct impacts to waters of the United Sta tes are still proposed after full incorporation of avoidance and minimization measures. Details on the unavoidable direct impacts proposed with this application are provided in Chapter 3 of the FEISs. The compen satory stream mitigation for the I-73 project will be provided through permittee-responsible mitigation a nd includes restoration, enhancement, and preserva tion of headwater stream reaches. This mitigation plan was developed and will be implemented based upon an integrated watershed plan to identify large-scale mitigation in a regionally important context in accordance with the USACE and the USEPA 2008 mitigation rule (33 CFR Parts 325 and 332, 40 CFR Part 230).

Mitigation opportunities have been sought within th e project study area following the guidance of comm enting agencies, the 404 Guidelines, and the use of a wate rshed approach as espoused in the mitigation rule (33 CFR 332.3(c)). The watershed approach outlines a strate gic site selection process that seeks to maintain a nd improve water quality and aquatic resources wihtin the USGS 8-digit HUCs (i.e. primary watersheds) where the proposed project is located. The following draft fi nal stream mitigation plan is a culmination of agen cy input and analysis using the watershed approach. The Long Branch Stream Mitigation Site (hereafter referred to as the

"Site") is located approximately 6.2 miles from the preferred I-73 Preferred Alternative (Little Pee Dee sub-basin) and was identified as a unique opportunity to provide permittee-responsible stream mitigation commensurate with the proposed impacts of the I-73 project (Figure 1).

2.0 AVAILABLE MITIGATION CREDIT

Compensatory mitigation was discussed early and frequently during the NEPA process for I-73 at the ACT meetings. Discussions on the use of commercially available mitigation banks occurred at these meetings and the general consensus of the ACT was that if an approved mitigation bank were available, a project the size of I-73 could result in the purchase of all available credits and could close the bank to use by other projects in the area. All agreed that for a project of this magnitude, permittee-responsible mitigation would be appropriate.

Based on the USACE Regulatory In lieu fee and Bank Information Tracking System (RIBITS), there are currently there are no stream mitigation banks that service the I-73 project.

3.0 WATERSHED APPROACH

In an effort to promote the environmental stewardship in transportation projects and expedite environmental review of high-priority transportation infrastructure (Executive Order 13274, 2002), the FHWA and SCDOT formed the ACT on July 30, 2004. The ACT was a group of representatives from state and federal cooperating agencies that provided input and helped make project decisions including those that pertained to wetland and stream impacts and the concomitant mitigation approach. Mitigation was discussed at several ACT meetings and additional meetings were conducted to specifically discuss mitigation (see Chapter 4.2 of the FEISs for a summary of the ACT meetings). The importance of in-kind mitigation and mitigation within the same watershed was emphasized. It has been agreed upon by the SCDOT and the USACE Charleston District that one Section 404 permit will be obtained for I-73 in South Carolina; therefore, one mitigation plan would be prepared. However, a single site that would provide both wetland and stream mitigation opportunities was not identified. Therefore, one site was selected to satisfy the wetland requirements and another was selected to provide stream mitigation.

The USACE established guidance for calculating the number of impact credits that would be needed to compensate for unavoidable wetland and stream impacts. This guidance is contained in the Charleston District USACE Guidelines, dated October 7, 2010 (Guidelines) (USACE 2010a). The number of mitigation credits required is based on several factors such as the type of wetland or stream being impacted, the condition of the area to be impacted, the type of impact that will occur, and the duration of the impact (permanent vs. temporary). The Charleston District Guidelines also contain guidance for calculating the number of mitigation credits that a proposed mitigation site will generate. The number of credits received for a mitigation site is determined by several factors such as the wetland or stream type, the wetland or stream priority category, the net improvement to the area for proposed restoration or enhancement, the credit schedule (before the impacts versus after), and the location of the proposed mitigation site (within or outside the same 8-digit HUC and eco-region). The proximity of the mitigation site to the impact site, the type of protection the site will receive, and whether the mitigation wetland or stream is the same type as the impacted wetland or stream are considered regardless of the mitigation type that is proposed.

On April 10, 2007, the ACT agreed that the Guidelines would provide a method for assuring that adequate mitigation would be provided for wetland and stream impacts associated with impact for the I-73 project. At the recommendation of the members of ACT it was agreed that wetland and stream mitigation impacts will be calculated for each 11-digit HUC in which the impacts occur. The Guidelines will then be used to calculate the

required mitigation credits for the wetland and stream impacts in each HUC. Additional discussions revolved around the use of riparian systems as well as landscape scale mitigation with linked upland/riparian systems and possibly isolated wetland systems, such as Carolina bays. The use of commercial wetland mitigation banks was discussed by the ACT and it was suggested that they be used only as a last resort. As mentioned previously, there are currently no stream mitigation banks that service the I-73 project area.

The 33 CFR 332.3(c)/40 CFR 230.93(c) guidance to the watershed approach considerations to compensatory mitigation states that:

> "A watershed approach to mitigation considers the importance of landscape position and resource type of mitigation projects for the sustainability of aquatic resource functions within the watershed. It considers how the types and locations of compensatory mitigation projects will provide the desired aquatic resource functions, and function over time in a changing landscape. Considerations include:
>
> - Habitat requirements of important species
> - Habitat loss or conversion trends
> - Sources of watershed impairment
> - Current development trends
> - Requirements of other regulatory and non-regulatory programs that affect the watershed, such as storm water management or habitat conservation programs.
>
> A watershed approach includes the protection and maintenance of terrestrial resources, such as riparian areas and uplands, when those resources contribute to the overall ecological functioning of aquatic resources in the watershed."

The SCDHEC Watershed Water Quality Assessment, Pee Dee River Basin, identifies nine activities or conditions that pose a threat to water quality in the basin. These include agriculture, silviculture, urban areas, marinas and recreational boating, mining, hydromodification (stream channelization, channel modification, and dam construction), wetland loss, land disposal (landfills), and groundwater contamination.[1] The I-73 corridor is located predominantly in undeveloped areas where activities that threaten water quality are mainly agriculture, silviculture, and hydromodification.

The watershed approach to compensatory mitigation guidance and water quality threats were taken into consideration during the development of the Long Branch mitigation plan, as discussed below.

Wetlands and streams within the four-county I-73 study area have been severely impacted by historic and ongoing agricultural and silvicultural activities. This is especially true of the streams identified within the construction footprint of the I-73 project. The most prevalent impacts to streams observed within the project study area consisted of channelization/straightening of streams and disconnection from their floodplains. Therefore, the proposed mitigation efforts at Long Branch will provide ideal ecosystem-based improvements to a stream with impacts that typify the condition of streams in watersheds crossed by I-73. Nearly 98.5 percent of the stream impacts associated with the I-73 project occurs along the proposed alignment south of I-95. Therefore, the southern portion of the project study area was targeted for a potential stream mitigation site.

The following stream mitigation plan describes the permittee-responsible proposed ecosystem restoration and enhancement approach designed specifically to fulfill the SCDOT stream mitigation obligations for the I-73

[1] South Carolina Department of Health and Environmental Control. 2007. Watershed Water Quality Assessment: Pee Dee River Basin. Technical Report No. 005-07. Bureau of Water, Columbia, S.C.

project, which requires **22,640** stream credits. The required I-73 stream mitigation credit worksheets are provided in Appendix 2.

4.0 PROPOSED COMPENSATORY STREAM MITIGATION PLAN

4.1 Goals and Objectives

The proposed project will restore approximately 2,5 43 linear feet (LF) of stream, and enhance approxim ately 4,867 LF of stream along Long Branch, enhance appro ximately 5,565 LF of stream along Indian Pot Branch . Restoration is proposed for approximately 1,632 LF along two unnamed tributaries (UT1 and UT2) that fl ow into Long Branch. These activities will provide co mpensatory mitigation for adverse impacts to stream s under review by the USACE (#SAC 2008-1333-DIS). Restorat ion will include designing and constructing the appropriate channel dimensions, pattern and profile for the project reaches as part of a headwater wetland/stream complex. In addition to the restoration of the cha nnel itself, exotic invasive vegetation will be rem oved and native vegetation will be planted within the ripari an zone. The restored streams will also be protect ed in perpetuity though a conservation easement. Enhance ment will include any combination of excavating ban kfull benches, sloping stream banks, building in-stream s tructures to promote bedform diversity and provide bank stabilization, invasive exotic vegetation removal, planting native vegetation in the riparian zone, an d protection of the stream through a conservation easement.

The proposed site will provide numerous water quali ty, hydrologic, and ecological benefits within the Pee-Dee River Basin. While some of the benefits may be lim ited to the project site or the immediate vicinity, many benefits such as improved water quality, and habitat improvements, will have far-reaching effects throughout the region. Expected site benefits and improvements are outlined below as project goals in Table 1.

Table 1.
Primary Functional Benefits and Equivalency Standards of the Long Branch Site

Benefits Related to Water Quality	
Nutrient Removal	Benefit will be achieved through the removal of excess nutrients through filtration and nutrient uptake within the restored and enhanced vegetated buffers.
Sediment Removal	Benefit will be achieved through stabilization of eroding banks; installation of vegetation buffers; and restoration of a stream with the proper profile, dimension, and pattern to efficiently transport sediment, and by dissipating stream energy with overbank flow during storm events with greater than bankfull discharges.
Increased Dissolved Oxygen Concentration	Benefits will be achieved through the restoration of natural stream forms including riffle and pool sequences, which will increase dissolved oxygen concentrations. In addition, once the planted vegetated buffers mature, the increased shade will decrease water temperatures and increase dissolved oxygen concentrations.
Benefits Related to Hydrology	
Surface Storage and Retention	Benefits will be achieved through the installation of vegetated buffers, and stabilization of banks, which increase groundwater infiltration and recharge, increasing retention times.
Subsurface Water and Retention	Benefits will be achieved by reducing runoff velocity, increasing infiltration.
Benefits related to Ecological Processes	
Restoration of Terrestrial Habitat	Benefits will be achieved through the restoration and enhancement of physical structure, removal of invasive species and returning native vegetation to the restored buffer areas.
Restoration of Aquatic Habitat	Benefits will be achieved through the restoration and enhancement of streams and drainage pathways, and the installation of appropriate in-stream structures.
Equivalency to Mitigation Bank Standards	
Watershed Approach	The scale of the project, location of the site, the likelihood of ecological success, and the hydrologic benefits to the watershed support the rational for restoration and enhancement of on-site streams.
Planning	Rigorous scientific and technical analysis was performed to support the Final Mitigation Plan.
Monitoring Requirements	The project will be subject to a five-year monitoring period, with defined ecological performance monitoring benchmarks.
Financial Assurances	Will be provided through the combination of an upfront escrow fund to cover work activities, with a long-term endowment to fund ongoing easement monitoring and enforcement equivalent to that required of a mitigation bank.

4.2 Site Selection

To honor the commitment of providing "landscape" sc ale mitigation for the I-73 project, a single site that would provide substantial stream length, while generating the required stream credits based on the Guideline s, was sought as mitigation. The original Brittons Neck s tream mitigation site, included in the Section 404 permit application package and site visit, was abandoned d ue in part to agency objections raised following a review of the conceptual mitigation plan. There were concern s that future development activities upstream of th e project site could jeopardize the project's success. There fore, a headwater stream reach was sought, resultin g in the selection of the Long Branch site.

The Long Branch site is a headwater stream system a nd will provide approximately 94 acres of protected wetland/upland riparian area of varying width and approximately 14,607 LF of stream restoration/enhancement. The site and its associated wildlife habitat will b e protected through a conservation easement that wi ll be held and maintained by a third-party, such as The Nature Conservancy. Additionally, the proposed mitigatio n site abuts Little Pee Dee State Park providing an extens ive protected corridor, which would meet the SCDOT' s understanding of the term "landscape" scale mitigation site.

One major challenge for SCDOT in developing the Lon g Branch mitigation site involved coordination with property owners for the establishment of the conser vation easements. Ten individuals and families ow n properties that abut the streams that make up the S ite, and eight of the ten owners have agreed to par ticipate in the mitigation project. The tracts that belong to the two owners that are not willing to participate are located on the western side of Indian Pot Branch at the southe rn extent of the Site which resulted in an easement only on one side of this section of the stream. The portio n of these two tracts that would have been included in the conservation easement consists of wetlands, specifi cally wooded swamp, and cannot be readily developed without obtaining a Section 404 permit; therefore we believe that not including an easement on these tracts does not detract from the overall ecological benefits th at the Long Branch mitigation site provides. With a few exceptions, to accommodate land owners needs and an existing powerline easement, the final conservatio n easement negotiations allow for a minimum of 75-foo t wide buffers along the outer meanders of the rest oration sections and the enhancement sections will generally have 150-foot buffers along both banks of the streams.

The Site is located 4.4 miles northeast of the comm unity of Floydale in Dillon County, South Carolina, approximately 7 miles southeast of Dillon (Figure 2). The Site is located in HUC 03040204 (Little Pee Dee River) and is less than 7 miles from the proposed I -73 project corridor. The southern extent of the S ite borders Joann Branch Road which also forms the northern bou ndary of the Little Pee Dee State Park. Restoration of Long Branch and its immediate surroundings present an ideal opportunity to pursue landscape-scale, ecologically meaningful, stream mitigation. The Si te encompasses the most of Long Branch and over hal f of Indian Pot Branch, which discharges to the Little Pee Dee River southwest of the Site. The Little Pee Dee River is designated as an Outstanding Water Resource (ORW) by SCDHEC, and an Aquatic Resource of National Importance (ARNI) by the USEPA. The Site offers the opportunity to restore and enhance headwater ripar ian communities, and preserve bottomland hardwood, wood ed swamp, and freshwater marsh riparian habitats th at closely approximate the stream and wetland types im pacted by I-73. As mentioned above, the streams th at would be affected by I-73 were previously impacted by predominantly agricultural and silvicultural act ivities. The proposed stream restoration at Long Branch woul d correct in-kind stream impacts representative of conditions of streams within the I-73 project water shed. The Site mitigation plan is predominantly restorat ion and enhancement based and offers a high probability for success. Headwater streams, riparian communit ies, upland buffers, water quality, and wildlife habitat would concurrently improve through the development of the Site. The proposed site will also provide an appro ximately 2.8-mile long protected riparian corridor that will terminate at the northern boundary of Little Pee Dee State Park, located at the southern extent of the site.

The mitigation plan includes restoration and enhanc ement of similar ecosystems impacted by the I-73 pr oject. Streams within the I-73 corridor are primarily brownwater systems that have been channelized and disconnected from their associated floodplains. Approximately 32 percent of the stream impacts associated with I-73 occur in 1st and 2 nd order streams. The upper portion of Long Branch ha s been extensively channelized, is no longer connected to its floodplain, and is surrounded by a gricultural fields. Its associated floodplain wetl ands have been largely drained in the portion north of Stubbs Road leaving only a small disconnected remnant wet land at the northeastern end of Section G. The lower porti on has also been channelized and deepened and has a djacent areas of active silviculture (planted pines), but still retains some connections to its adjacent floodplain.

The Site will be utilized to satisfy the stream mit igation requirements of the South Carolina portion of the I-73 project. The stream mitigation requirements for I-73 in South Carolina consist of **22,640** credits, of which up to 75 percent may be preservation (refer to Appendix 2). Table 2 provides a breakdown of the project str eam impacts by 8-digit HUC, stream type, and ecoregion.

Table 2.

I-73 Impacts by HUC, Ecoregion, and Stream Type

Impact by HUC:	**Linear feet**	**Percentage**
03040204*	3,633 LF	78.25%
03040201	703 LF	15.14%
03040206	307 LF	6.61%
Totals:	**4,643 LF**	**100%**
Impacts by Ecoregion:		
Southeastern Plains*	2,246 LF	48.37%
Mid-Atlantic Coastal Plain	2,397 LF	51.63%
Totals:	**4,643 LF**	**100%**
Impacts by Type:		
Intermittent	1,496 LF	32.22%
Perennial*	3,147 LF	67.78%
Totals:	**4,643 LF**	**100%**
*Long Branch is located in this HUC, Ecoregion, and is Perennial		

Regarding the type of mitigation required for the S CDOT projects, the following assumptions were made based on discussions with the ACT during the EIS process:

The Mitigation Credit Calculations are Defined Based on the 2010 Guidelines.

- During the preparation of the EIS the ACT, comprise d of FHWA, NOAA-NMFS, NRCS, SCDAH, SCDHEC-OCRM, SCDHEC, SCDNR, SCDOC, SCDOT, SCEMD, SC PRT, USACE, USCG, USEPA, and USFWS, agreed that the USACE Guidelines would p rovide a method for assuring that adequate mitigation would be provided for wetland and stream impacts associated with the construction of I-73. At the recommendation of the members of ACT it was agreed that wetland and stream mitigation impacts were to be calculated for each 11-digit Hyd rologic Unit Code (HUC) in which the impacts occur. The Guidelines were to be used to calculate the required mitigation credits for the wetland and stream impacts in each HUC.

- The mitigation is required to offset impacts in HUCs 03040204, 03040201, and 03040206, but the mitigation project site may be located in any of these HUCs based on overall watershed benefits to address the impacts across multiple HUCs;
- Larger, landscape-scale mitigation is preferable to multiple smaller mitigation sites;
- A portion of the wetland mitigation need will be satisfied by the SCDOT Sandy Island Mitigation Bank (1,500 wetland preservation credits)[2]; and
- There was no requirement or desire to locate mitigation in any specific county as long as the Guidelines requirement are met.

The overall mitigation plan includes two mitigation sites and the use of an approved mitigation bank which, when combined, address the I-73 mitigation needs of SCDOT. The first site, Joiner Bay, is a landscape scale wetlands restoration/enhancement project with multiple wetland types matching the various impacted habitats along the I-73 corridor (the Joiner Bay site is discussed in detail in a separate Mitigation Plan document). The site is located two miles from the I-73 Preferred Corridor in western Horry County within the same watershed containing the majority of the wetland impacts. The second site, Long Branch, discussed in this plan, is a Coastal Plain stream restoration/enhancement site located in the watershed covering the majority of the southern section of the I-73 Preferred Corridor. SCDOT will purchase the remaining 1,500 credits from one or more mitigation banks expected to be approved in the near future as part of this Final Mitigation Plan. As stated above, the USACE 2010 Guidelines were used to determine the required and proposed mitigation credits. As written, this mitigation plan meets and exceeds these requirements, not only regarding the calculation of credits but also buffer requirements, and preservation to restoration ratio.

4.2.1 Hydrological conditions, soil characteristics, and other physical and chemical characteristics

Long Branch is classified as a freshwater perennial stream and is a tributary to Indian Pot Branch, also a perennial stream. Tributaries to the proposed stream mitigation site consist of predominantly ephemeral and intermittent streams and one perennial stream, Butler Branch. All are brownwater Coastal Plain systems that have been channelized. With the exception of Indian Pot Branch, all have been largely disconnected from their associated floodplains and floodplain wetlands. Indian Pot Branch ultimately discharges to the Little Pee Dee River which is designated as an ORW by SCDHEC, and an ARNI by USEPA. The restoration and enhancement of a direct tributary of the Little Pee Dee River will have a positive effect on this valuable resource by improving water quality input and reducing the possibility of future impacts to Long Branch and Indian Pot Branch through the establishment of conservation easements.

Soils within the mitigation site are mapped as primarily Coxville fine sandy loam or Johnston-Rutlege association, frequently flooded by the NRCS. Both are classified as hydric soils for the entire map unit (Figure 3). Much of the riparian corridor has been impacted by past and current logging and agriculture activities, which has resulted in the reduction of native species diversity. In addition, invasive plant species such as Chinese privet (*Ligustrum sinense*) and Chinese wisteria (*Wisteria sinense*) have become established throughout most of the adjacent forested areas.

The portions of the channels north of Stubbs Road traverse through agricultural fields and are subject to both sediment and chemical pollutants in stormwater runoff. Reestablishing the riparian buffer would protect the channels from these sources of non-point source pollution. There is an existing National Pollutant Discharge Elimination System (NPDES) permit for the Trico/Bermuda Water Treatment Plant (SCG645021 and SCG646037) located at the corner of Bermuda Road and State Park Road, approximately 1,900 feet west of Long Branch. This facility is permitted for a 34,600 gallon per day discharge into a ditch along Bermuda Road that discharges into Long Branch. The permit allows the discharge of total suspended solids, chlorine, phosphorus, and iron. The constituents originate from the back-washing process of potable water lines and

[2] The remaining 1,500 mitigation credits at Sandy Island were subsequently used for the Carolina Bays Parkway project and are no longer available for use for I-73.

filters. The water is first discharged into a holding pond where it is held and tested until the chlorine has burned off and iron and sediments have settled out prior t o discharge into the ditch, which occurs once each week. Monthly reports of the testing results are submitte d to SCHEC. When sediment and/or iron accumulates in the pond, it is pumped out and disposed of at a sanitar y water treatment facility. [3] It is anticipated that the water treatment plant will have no adverse affects to the Site.

4.2.2 Watershed-scale features

Aquatic habitat diversity will be improved by resto ring a riffle-pool sequence that will provide nativ e aquatic species with areas for cover, for finding food and for reproduction. Habitat diversity will also be i mproved by including woody debris in the design. The protecte d vegetated buffer that will connect to Pee Dee Sta te park will filter runoff from the adjacent agricultural fields, which will improve water quality and downstream habitat, and provide a corridor for terrestrial wildlife mov ement. With the exception of two tracts situated a long the western bank of Indian Pot Branch, the conservation easement will provide permanent protection for approximately 94 acres of riparian habitat that connects to the Little Pee Dee State Park, located south of Joannn Branch Road at the southern extent of the Site.

4.2.3 Size and location of compensatory mitigation site

The Site is located less than 7 miles from the prop osed I-73 project corridor in HUC 03040204 (Little Pee Dee River) where approximately 78 percent of the I-73 s tream impacts occur . I-73 crosses two ecoregions, the Southeastern Plains to the north of the Marion/Dill on County line, and the Mid-Atlantic Coastal Plain on the south side of the Marion/Dillon County line. Break ing the I-73 stream impacts down by ecoregion, approximately 48 percent would occur in the Southea stern Plains, and approximately 52 percent would oc cur in the Mid-Atlantic Coastal Plain. The Site is locate d approximately 11 miles north of the Mid-Atlantic Coastal Plain/Southeastern Plains boundary (Figure 4). The restoration and enhancement of Long Branch and its associated riparian corridor present an ideal oppor tunity to pursue landscape-scale, ecologically mean ingful, stream mitigation. The site will protect an approx imately 2.8-mile long corridor that connects to Lit tle Pee Dee State Park, providing a protected corridor for wildlife.

4.2.4 Compatibility with adjacent land uses and watershed management plans

Current adjacent land use includes agriculture and silviculture. The protected buffer will help to fi lter sediment and nutrients in runoff from these areas before ent ering the streams. The land use is not expected to change or substantially increase in impervious area within the next 15 to 20 years.

4.2.5 Effects compensatory mitigation project will have on ecologically important resources

The restoration and enhancement of the site will im prove the water quality and habitat of the Little P ee Dee River. The Little Pee Dee River is designated as a n ORW by SCDHEC, and an ARNI by USEPA. The site is also adjacent to the Little Pee Dee State Park, an 835-acre site park which includes Carolina bay habi tat and serves as an important recreational fishing site. Other recreational activities available at the Little Pee Dee State Park include boating, camping, hiking, biking, picn icking, birding/wildlife watching, geocaching, and other outdoor recreational activities.

Background research was conducted at the South Caro lina Institute of Archaeology and Anthropology (SCIAA) and included a review of the South Carolina Departm ent of Archives and History and SCIAA GIS database (ArchSite) and state archaeological site files. Re sults of the database search can be found in Append ix 3. Although nine previously recorded archaeological sites were identified within a 0.5 mile of the project site, none were located within the project site and none of the sites in closest proximity were determined eligible for listing in the National Register of Historic Places (NRHP). These archaeological sites were located south of Bell Swamp Branch and were identified as part of a 1993 survey. In addition, the *Historic Architectural Survey of*

[3] Personal communication with Mr. Will Arnette (Tric o Water Company). July 10, 2013.

Dillon County (Bailey et al, 2011) identified 14 historic structures located within or in a 0.5-mile search radius of the project site. Of the seven historic structures that were identified within the project site along Hayestown Road and State Park Road, including the Bermuda Cemetery and the Hayestown Pentecostal Holiness Church, none were recommended eligible for listing in the NRHP. Two NRHP-listed sites, the Smith Barn and the Meekins Barn, are located approximately 0.25 mile outside of the project site and will not be impacted by this project.

Species with the federal classification of Endangered, Threatened, or officially proposed for such listing are protected under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). The term "Endangered Species" is defined as "any species which is in danger of extinction throughout all or a significant portion of its range;" and the term "Threatened Species" is defined as "any species which is likely to become an Endangered Species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C. 1532). Table 3 provides the most recent list of federally protected species for Dillon County according to the USFWS.

Table 3.

Federally Protected Species Occurring in Dillon County

Common Name	Scientific Name	Federal Status
Atlantic Sturgeon	*Acipenser oxyrinchus*	Endangered
Bald Eagle	*Haliaeetus leucocephalus*	Bald and Golden Eagle Protection Act
Red-cockaded woodpecker	*Picoides borealis*	Endangered
Shortnose Sturgeon	*Acipenser brevirostrum*	Endangered

Atlantic Sturgeon

The Atlantic sturgeon is a long-lived, estuarine dependent, anadromous fish. Atlantic sturgeon can grow to approximately 14 feet long and can weigh up to 800 pounds. They are bluish-black or olive brown dorsally with paler sides and a white belly. They have five major rows of dermal scutes. Atlantic sturgeon are similar in appearance to Shortnose sturgeon. Atlantic sturgeon have documented ages of up to 60 years. Atlantic sturgeon adults spawn in freshwater in the spring and early summer and migrate into estuarine and marine waters where they spend most of their lives. They spawn in moderately flowing water in deep parts of large rivers (US Department of Commerce, 2012).

Biological Conclusion: **No Effect**

The small size of Long Branch and its tributaries is not suitable for Atlantic sturgeon spawning. In addition, while the Little Pee Dee River could potentially be used for spawning by the Atlantic sturgeon, Long Branch flows into a dammed pond in the Little Pee Dee State Park creating a physical barrier that prevents the fish from traveling further upstream.

According to SCDNR, they have two fish sampling stations located on the Little Pee Dee River for the purpose of tracking the migration of radio-tagged Atlantic and shortnose sturgeon. The sampling stations are located at the confluence with the Great Pee Dee River and the other is at the U.S. Route 378 crossing. SCDNR indicated that based on past fish sampling efforts and experience with sturgeons, most bypass the Little Pee Dee River and migrate up the Great Pee Dee River to spawn. Based on the results of their tagged fish surveys, they have no records of either the Atlantic or shortnose sturgeon in the Little Pee Dee River at the U.S. Route 378 sampling station, which is located approximately 50 river-miles downstream of the Site. They indicated that untagged fish

could be present in the Little Pee Dee River; however, based on the description of the habitat in the vicinity of I-73,(near the crossing of the Little Pee Dee River by S.C. Route 917 – located downstream of the Site) it is not likely that sturgeons would be present. [4] SCDNR indicated that they have conducted "snap-shot" gill netting while studying other diadromous fish in the Little Pee Dee and no sturgeons were captured during those efforts.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) was formerly protected under the Endangered Species Act until June, 2007, when it was determined to be recovered and was subsequently delisted. It is, however, still federally protected under The Bald and Golden Eagle Protection Act, which prohibits any form of taking of both bald and golden eagles except as provided by permit. The act makes it illegal to possess or sell an eagle or any part of an eagle (i.e., feathers, talons, eggs, or nests), and any "taking" of an eagle which includes killing, harassing, disturbing, or poisoning.

The bald eagle is a large bird of prey with a dark brown body and conspicuous white coloration on the head, neck, and tail. Its wingspan may reach up to seven feet, and it can weigh as much seven pounds as an adult.

The bald eagle requires large trees with an open limb structure for nesting, usually in a forest/marsh ecotone within one kilometer (0.62 mile) of open water. Large trees allow for large nests that can support nesting for many years without falling. The open limb structure provides easy access and a clear view of foraging habitat. Nesting habitats initially selected by eagles usually have limited disturbance. Trees suitable for perching and future nesting sites are also important components of stable nesting territories. Fresh, brackish and marine habitats provide suitable foraging sites and include open water, marsh and riverine types. Prime habitats are characterized by having shallow, slow moving water with abundant fish and bird prey. Preferred sites have suitable perch and roost sites with minimal disturbance. Large manmade reservoirs in South Carolina have provided many acres of new inland eagle foraging habitat. Concentrations of eagles may be found below hydroelectric dams where they forage on injured fish. Impounded marsh managed for waterfowl is also preferred foraging and nesting habitat (SCDNR, 2006).

Human disturbance can cause an eagle to abandon otherwise suitable habitat. The breeding season for the bald eagle begins in December or January. Fish are the major food source for bald eagles. Other sources include coots, herons, and wounded ducks. Food may be live or carrion.

Biological Conclusion: **No Effect**

No suitable nesting or foraging habitat was observed in, or immediately adjacent to, the stream reaches where morphological or vegetative manipulation of the stream or its buffer are proposed.

Red-Cockaded Woodpecker

The red-cockaded woodpecker (*Picoides borealis*) is a small woodpecker with a wingspan up to 15 inches. The bird has black and white horizontal stripes on its back, white cheeks and breast, black-streaked flanks, and a black cap and throat. Males have small red spots or "cockades" on each side of the cap just behind the eye, which is not easily discernible in the field (Henry, 1989).

Preferred nesting habitat of the red-cockaded woodpecker is old-growth pine forest (stems ≥ 60 years old) that is relatively free of hardwood undergrowth. Suitable foraging habitat includes pine and pine hardwood stands with pine stems ≥ 30 years of age. Foraging habitat is contiguous with nesting habitat, therefore colonies typically require areas of at least 100 acres of suitable habitat. Threats to this species include loss of old-growth longleaf pine habitat, fire suppression that allows the growth of a dense hardwood and vine understory in areas that

[4] Personal communication with Mr. Bill Post (SCDNR Marine Resource Research Institute). December 11, 2012

would otherwise be suitable for nesting habitat, and timber management practices that result in harvesting of pines before they reach a size that is suitable for establishment of red-cockaded woodpecker nest colonies.

Biological Conclusion: **No Effect**

Suitable habitat for the red-cockaded woodpecker is not present within the project area. The disturbed communities do contain pine species; however, there are no pine species greater than 60 years old and the communities are too fragmented to be considered suitable habitat.

Shortnose Sturgeon

The shortnose sturgeon (*Acipenser brevirostrum*) is a primitive fish that reaches a maximum length of around four feet. Instead of scales, this fish has five rows of boney plates called scutes that run the length of the body with one row located on each side, one down the back, and two down the belly. Color is olive gray to yellowish brown, with darker coloration along the top of the body, and a pale underside. The upper lobe of the forked tail is longer than the lower. Sturgeons have mouths that protrude from the underside of the snout, enabling foraging along the substrate for prey items such as mussels and crustaceans. The snout of shortnose sturgeon is shorter and blunter than that of the Atlantic sturgeon.

The shortnose sturgeon is found in riverine, estuarine, and occasionally near-shore marine environments of eastern North America and the Atlantic Ocean. Spawning and larval stages of the life cycle typically occur in freshwater channels of large, unobstructed river basins from as far inland as the fall line to the zone of tidal influence in estuarine or brackish channels. Foraging occurs near the freshwater/saltwater interface in riverine and estuarine environments, i.e., sounds and bays of river basin deltas. In South Carolina, the drainage basins utilized for spawning and foraging are the Pee Dee/ Waccamaw, Santee, Cooper, ACE Basin (Ashepoo, Combahee and Edisto rivers), and Savannah. Threats include pollution, incidental take by commercial fisheries, impingement at hydroelectric and nuclear power intakes, poaching, and alteration of habitat due to damming of rivers (US Department of Commerce, 1998).

Biological Conclusion: **No Effect**

Like the Atlantic sturgeon, the small size of Long Branch and its tributaries is not suitable for Shortnose Sturgeon spawning. In addition, while the Little Pee Dee River could be potentially be used for spawning by the Shortnose sturgeon, Long Branch flows into a dammed pond in the Little Pee Dee State Park creating a physical barrier that prevents the fish from traveling further upstream. Additional coordination that occurred with SCDNR in relation to the likelihood of sturgeon species utilizing the Little Pee Dee River is discussed under Atlantic sturgeon above.

4.3 Site Protection

A permanent conservation easement approximately 94 acres in size will be placed on the project to protect the mitigation work in perpetuity (Figure 5). Option agreements have been secured with project landowners that allow the recordation of a permanent conservation easement upon approval of the site for mitigation by the USACE. The conservation easement will be held by The Nature Concervancy, or other qualified land management entity approved by the USACE. The conservation easement will be equivalent to the easement template provided on the USACE Charleston District Website (Appendix 4).

4.4 Baseline Conditions

4.4.1 Project Impact Site

Project site information for the I-73 project can be found in the FEIS's[5] as follows:

- On-site wetland resources are discussed in Chapter 3.12.4.1-7 in the Southern document and Chapter 3.12.4.1-5 in the Northern document and streams are discussed in Chapter 3.12.4.8 in the Southern document and Chapter 3.12.4.6 in the Northern document.
- Direct impacts to wetland systems are discussed in Chapters 3.12.5-8 of the Southern and Northern documents, and stream impacts are discussed in Chapters 3.12.9 of both documents. Indirect and cumulative impacts to wetlands and streams are discussed in Chapter 3.12.10-11 of the Southern and Northern FEISs.
- Credit calculations are discussed in Chapter 3.12.14 of the Southern and Northern FEISs. The USACE 2002 Mitigation SOP was used originally to calculate wetland and stream mitigation credits required for the construction of I-73. Since that time the 2010 Charleston District Guidelines were issued and revised Guidelines worksheets have been completed and replaced the previously submitted 2002 SOP. Wetland and stream mitigation credit impacts were calculated using the 2010 Guidelines for each 11-digit HUC in which the impacts occur (Appendix 2). The assignment of Guidelines worksheet factors for each wetland area and stream was conducted based upon the following observations:

(a) The lost type was assigned based upon general plant community assigned during the delineation phase with the majority assumed to be bottomland hardwoods or wooded swamps and given the Type A classification. Some wetlands located within Horry County were classified as pocosins, pine wet flatwoods and/or pine savannah and, therefore, given the Type B classification, however, these were not common. The plant community classification was confirmed based upon site visits, photographs, and review of data forms and field notes. Man-made features such as ponds, jurisdictional ditches, and borrow pits were assumed to be Type C as defined by the Guidelines. Streams were handled in a manner similar to the wetlands with the assumptions that intermittent streams were classified as 1st and 2nd Order RPW's and perennial streams were classified as "All Other Streams."

(b) The priority category was assigned based upon the definitions given in the Guidelines. Only the wetlands located adjacent to the Little Pee Dee River were classified as Primary Priority Category waters due to their location in a State Heritage Trust site. The remaining wetlands were all classified as Tertiary Priority Category waters. Man-made features such as ponds, jurisdictional ditches, and borrow pits were assumed to be Tertiary Priority Category waters. All streams were Tertiary Priority except for the Little Pee Dee River which is Primary Priority

(c) All of the wetlands and streams were previously impacted to some degree due to the history of agriculture and silviculture in the region. The existing condition of the wetlands was assumed to be "impacted" and then adjusted according to site-specific conditions. The evaluation of each site was based upon site visits, photographs, and review of data forms and field notes. The least impacted wetlands were located adjacent to the Little Pee Dee River. Even these wetlands showed some impacts such as reduced species diversity due to logging, presence of old causeway and rip-rap, ditching, installation of pipes/culverts, presence of invasive species, excavation, presence of man-made debris, and habitat fragmentation. Man-made features such as ponds, jurisdictional ditches, and borrow pits were assumed to be "very impacted" as they are not truly wetlands but more closely resemble open

[5] http://www.i73insc.com/default.shtml

water features. Streams were found to be unstable, channelized, accessed by cattle, straightened, and/or disconnected from their adjacent wetlands (as evide nced by presence of erosion and sedimentation, presence of spoil piles, excavation, installation o f pipes/culverts, vertical embankments, incision, presence of man-made debris, etc.) and, therefore, all streams were impacted to some degree. Low Gradient Stream Assessment Data Sheets were complet ed for each stream within the project corridor and the appropriate condition factor was recorded. Copies of the completed Low Gradient Stream Assessment Data Sheets are included with the 2010 Guidelines worksheets.

(d) Duration was assigned the maximum value of 2.0 for fill and permanent clearing and 1.0 for temporary clearing for wetlands. All impacts to streams will be permanent in duration.

(e) The dominant impacts were assigned either that for fill, clear, or dredge based upon the impact shown on the design drawings. The dominant impacts for s treams will be piping or culverting as determined by the impact definitions (less than 100 feet of im pact = culverting; greater than 100 feet of impact = piping).

(f) The cumulative impact was calculated by watershed a nd included the cumulative impacted acreage of all wetland areas regardless of jurisdictional stat us, all jurisdictional ditches and ponds, all non-jurisdictional ponds, and some non-jurisdictional d itches. A number of non-jurisdictional ponds were considered to be solely agricultural in nature and were removed from the drawings and the acreage calculations. Criteria for determining the agricult ural status included such factors as excavation in uplands, lack of remnant wetlands or other drainage features in the immediate vicinity, lack of hydric soil characteristics, and historic information from soil surveys and aerial photography. Areas such as non-jurisdictional ditches and ponds were not inclu ded in the final mitigation calculations although t he impacted acreage for these areas is included in the total impacted acreage.

In order to simplify the calculation of the credits , all of the information was entered into a Microso ft Excel spreadsheet and the spreadsheet was used to group t he impacted areas into a minimum number of categori es based on the total number of possible combinations of the above factors for each watershed. The combi ned categories were then transcribed to the 2010 Guidel ines worksheets and the final total required credit s were calculated.

The overall strategy for calculating the required credits was presented to the USACE in an informal meeting and the USACE was asked to provide recommendations conc erning the methods and assignment of the factors pr ior to the submittal of the permit application. Based upon the guidance received from the USACE, some chan ges to the assignment of factors and the calculation of the credits were incorporated into the spreadsheets and the 2010 Guidelines worksheets were adjusted accordingly.

Based upon the 2010 Guidelines worksheets, a total of **22,640** stream credits will be required. A copy of the USACE Charleston District Compensatory Mitigation 2 010 Guidelines worksheets are in Appendix 2. Low Gradient Stream Assessment Data Sheets were complet ed for each stream within the project corridor and the appropriate condition factor was recorded. Copies of the completed Low Gradient Stream Assessment Dat a Sheets are included with the 2010 Guidelines worksheets.

4.4.2 Proposed Mitigation Site

The Long Branch site (Site) is located within Bell Swamp Branch Subbasin of the Pee-Dee River Basin an d is part of the USGS Hydrologic Unit Code 030402040506 (Figure 4). The Site is located along Hayestown Ro ad in Dillon County, South Carolina within the Coastal Plain physiographic province; specifically the Southeastern Plains ecoregion of South Carolina. The Southeaste rn Plains ecoregion is low, flat, gently rolling wi th fine textured soils. It is a major agricultural zone, w ith deep, well-drained soils, and a large amount of cropland. The sedimentary formations are younger than those o f the Sand Hills and older and more dissected than the flatter terraces of the Carolina Flatwoods. The fl ora is varied due to the variety of edaphic conditi ons. The

region has a high concentration of Carolina bays. These are shallow, elliptical depressions, often swampy or wet in the middle with dry sandy rims. Carolina bays not drained for agriculture often contain rare or endangered plant and animal species.

The majority of the land use in the vicinity of the project and within the project watershed is agricultural cropland and forest. Impervious surfaces account for less than 5 percent of the project watershed, and are not anticipated to change significantly within the next 15 to 20 years.

The mitigation site consists of approximately 7,410 LF of Long Branch, approximately 5,565 LF of Indian Pot Branch and approximately 1,632 LF of two UTs to Long Branch (Figure 5). The streams have been impacted by past channelization, loss of riparian buffers, channel incision, and adjacent agricultural land use. The streams were historically channelized and straightened to reduce flooding and provide drainage for the adjacent fields and lands. All streams ultimately flow into Pee Dee State Park Lake and then into the Little Pee Dee River.

The existing channel on Long Branch is classified as Rosgen G5/B5c stream type (Rosgen, 1996). Survey data for the existing stream condition can be found in Appendix 5. In some locations the channel is sufficiently wide with a moderate entrenchment ratio that supports the classification of the stream as a Bc channel. However, due to the incised and degraded condition of the stream, the restoration reach of Long Branch is functioning primarily as a G channel. UT1 and UT2 are classified as incised F5 stream types.

Soils within the mitigation site mapped by the NRCS are primarily Coxville fine sandy loam or Johnston - Rutlege association, frequently flooded. Both are classified as hydric soils for the entire map unit(Figure 3).

Coxville fine sandy loam (Co) consists of poorly drained soil on smooth flats and in slight depression in the uplands. It occurs in areas of irregular shape. Slopes are 0 to 2 percent with slow to ponded runoff and moderate infiltration.

Johnston-Rutlege association (JR) consists of very poorly drained soils found in drainageways and floodplains. Slopes are 0 to 2 percent and are frequently flooded.

More detailed geomorphology and sediment data will be included in the restoration design.

Jurisdictional Determination: Jurisdictional Waters of the United States were field delineated during the February 2-3 and 15-16, 2012 and June 17-18 and 25-26, 2013,time period on the basis of soils, hydrology, and vegetation as set forth by 1987 Corps of Engineers Wetlands Delineation Manual and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region. The USACE/USEPA will assert federal jurisdiction over wetlands that abut or are adjacent to traditionally navigable waters (TNWs, as described in 33 CFR §328(a)) and wetlands that abut non-navigable tributaries with a relatively permanent flow. The wetland boundaries identified during the field delineation were mapped using sub-meter accuracy Global Positioning System (GPS) equipment. The GPS data was used to generate a wetland map of the project study area. The preliminary wetland boundaries are indicated on Figure 6.

USFWS modification of the Cowardin system aggregates the approximately 275 Cowardin wetland types into 18 general categories based on vegetative composition. This modification was used to classify wetlands within the project study corridor by type, and then was enhanced further with detailed descriptions of specific wetland and upland types of South Carolina found in The Natural Communities of South Carolina (Nelson, 1986).

The jurisdictional areas were flagged with surveyors flagging tape marked using an alpha-numeric numbering system. Appropriate data forms for the various wet land areas and wetland types were completed as well as for the adjacent upland areas for comparison. A request for a Jurisdictional Determination will be submitted to the USACE for approval in August, 2013.

Plant Communities: Plant communities were surveyed during the field work for the wetland delineation. Wetlands found in the project study corridor are dominated by trees, shrubs, or persistent emergent plants,

mosses, or lichens; and/or ponded areas less than 2 0 acres in size. Wetlands within the project study area fall into three major classes; forested wetlands (i.e. b ottomland hardwoods), non-forested wetlands (freshw ater marsh), and wetlands characterized as having uncons olidated bottom sediments and less than 30 percent vegetative cover in the wetland (i.e. ponds and bor row pits). Uplands identified within the project s tudy area during the field surveys, as described below, included mesic mixed hardwood forest, pine flatwood/planted pine forests, and disturbed areas (i.e. agricultural fields and maintained rights-of-ways).

The following are descriptions of the plant communi ties identified in the project study corridor. A li st of representative plant species observed on the Site is included in Appendix 6.

WETLAND COMMUNITIES

Approximately 47 acres of the buffer within the con servation easement are wetland. The wetland habita ts are associated predominantly with the lower portion of Long Branch and Indian Pot Branch, south of Bermuda Road, with a small wetland within the easement for Section G at the northern end of the project.

Bottomland Hardwoods: Bottomland hardwoods are wetlands that are typical ly associated with rivers, creeks, or other drainage systems. These low-lying bottoml ands frequently serve as a holding area for overflo w waters from a main channel, especially after a heavy rain event. They may also occur in low areas and along ephemeral streams that are temporarily flooded or saturated d uring the growing season. Portions of the bottomla nd hardwoods in the proposed preservation reach were i nundated at the time of the delineation. These are as were dominated by red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), willow oak (*Quercus phellos*), water oak (*Quercus nigra*), swamp black-gum (*Nyssa biflora*), and loblolly pine (*Pinus taeda*) or pond pine (*Pinus serotina*). The understory was dominated by red-bay (*Persea borbonia*), fetterbush (*Lyonia lucida*), wax-myrtle (*Morella cerifera*), and sweet-bay (*Magnolia virginiana*). Vines included muscadine (*Vitis rotundifolia*), poison-ivy (*Toxicodendron radicans*), bamboo vine (*Smilax laurifolia*), and greenbrier (*Smilax rotundifolia*). The herb layer was dominated by several species of fern, including netted chain fern (*Woodwardia areolata*), cinnamon fern (*Osmunda cinnamomea*), and royal fern (*Osmunda regalis*). Giant cane (*Arundinaria gigantea*) and lizard's-tail (*Saururus cernuus*) were also common in the herb layer.

Freshwater Marshes: Freshwater marshes are open wetlands with a highly variable water level dominated by emergent grasses, sedges, and rushes. This type of wetland is usually associated with deeper water we tlands, but can also be found where trees are not present a s in power line and roadway rights-of-way and other places where man prevents succession into, or back into, w ooded wetlands. Those identified within the proje ct study corridor during the wetland delineation were domina ted by smooth rush (*Juncus effusus*), broomsedge (*Andropogon virginicus*), and velvet panicum (*Dichanthelium scoparium*). Woody species on the edges of these marshes included redbay, sweetbay, gallberry (*Ilex coriacea*), fetterbush, wax-myrtle, and sweet pepperbush (*Clethra alnifolia*). The freshwater marshes found in the project study corridor were either within channels or in an open field that has been extensively altered by human disturbance (clearing, grading, and filling).

Wooded Swamp: Wooded swamps, also called bald cypress-tupelo swam p or swamp forest, are palustrine (freshwater) wetlands associated with black or brow nwater rivers. They are frequently deeply flooded, and seldom dry out completely (Nelson, 1986). The well -formed canopy is typically dominated by bald cypre ss (*Taxodium distichum*) and/or pond cypress (*T. ascendens*), and swamp tupelo (*Nyssa biflora*) and/or water tupelo (*N. aquatica*). These tree species have adaptations for growing in water, including swollen and buttressed bases, and, in the case of the Taxodium species, "k nees." The wooded swamps identified within the southernmost portion of the proposed preservation a rea had a relatively open canopy dominated by swamp tupelo and red maple. The shrub layer included ti-ti (*Cyrilla racemiflora*), elderberry (*Sambucus canadensis*) tag alder (*Alnus serrulata*), and saplings of the canopy species. Dominant her baceous plants consisted of woolgrass (*Scirpus cyperinus*), giant plume grass (*Saccharium giganteum*), giant cane, arrow arum (*Peltandra virginica*), spatterdock (*Nuphar luteum*), Asian spiderwort (*Murdannia keisak*), and false-nettle (*Boehmeria cylindrica*).

UPLAND COMMUNITIES

Approximately 42 acres of the buffer within the con servation easement area are uplands. Uplands are f ound predominantly along Long Branch, north of Bermuda R oad, with some uplands in the easement associated w ith Long Branch and Indian Pot Branch, south of Bermuda Road.

Mesic Mixed Hardwood Forest: Mesic mixed hardwood forests are moist upland wood s common in the piedmont, but also occur in the coastal plain. The canopy and understory is composed of a rich variet y of hardwoods, and the shrub and herbaceous species are numerous. The diversity of trees and other plants is great and there may be no dominant species (Nelson, 1986) . This plant community was located in a narrow ban d on the slope above the floodplain of the channels in o nly a few very limited locations. Typical overstor y species include water oak, tulip-poplar (*Liriodendron tulipifera*), sweet-gum, red maple, loblolly pine, and black g um (*Nyssa sylvatica*). The understory was dominated by horse-sugar (*Symplocos tinctoria*), red-bay, ti-ti, American holly (Ilex opaca), and American hornbeam (*Carpinus caroliniana*). There were stands of sweet pepperbush dominating the low shrub layer. The herbaceous lay er was sparse, with partridgeberry (*Mitchella repens*), common heartleaf (*Hexastylis arifolia*), and pipsissewa (*Chimaphila maculata*) comprising the dominant species.

Pine Flatwoods/Planted Pines: Pine flatwoods are uplands with an essentially flat or rolling terrain, sandy soil, and a high water table. They have a canopy of pine s and a well-developed sub-canopy of several tall s hrub species. These habitats are successional from the abandonment of cropland or other lands, and eventua lly succeed to deciduous hardwood-dominated forests. T hose identified within the project study area durin g the field survey were dominated by loblolly pine, water oak, red maple, black cherry (*Prunus serotina*), and sweet-gum in the canopy or near-canopy layer as saplings. The understory consisted of sweetleaf, wax-myrtle , American holly, and red-bay, with the occasional be autyberry (*Callicarpa americana*), and wild blueberry (*Vaccinium spp.*). Woody vines included catbriers (*Smilax rotundifolia* and *S. glauca*), yellow jessamine (*Gelsemium sempervirens*), muscadine, poison-ivy, and Japanese honeysuckle (*Lonicera japonica*). The herbaceous layer was dominated by bracken fern (*Pteridium aquilinum*) and ebony spleenwort (*Asplenium platyneuron*).

Planted pine stands were located adjacent to much o f the stream channel floodplains on the higher elev ations. They were typically very dense plantings of loblolly pines ranging in age from 10 – 15 year age class to 25 - 30 year class. A few pine trees were older but these were generally isolated individual trees within the stands of younger trees.

Disturbed Areas: In addition to the relatively natural areas describ ed above, the project study area contained extensive disturbed areas. Disturbed areas are tho se lands that have been highly impacted by the acti vities of man, and are either under cultivation for crops or timber production, or are built upon for residentia l or commercial purposes. Those identified within the p roject study area during the field survey were prim arily on uplands, and included the existing roadways and the adjacent minimally landscaped rights-of-way as wel l as agricultural fields and the previously described planted pine stands.

4.4.3 Reference Site

Reference reach surveys are valuable tools for comp arison. The morphologic data obtained such as dime nsion, pattern, and profile can be used as a template for design of a stable stream in a similar valley type with similar bed material. In order to extract the morphologica l relationships observed in a stable system, dimens ionless ratios are developed from the surveyed reference re ach. These ratios can be applied to a stream desig n to allow the designer to 'mimic' the natural, stable form ofthe target channel type.

Often the best reference data is from adjacent stab le stream reaches, or reaches within the same water shed. Reference data to help in the development of design criteria for Sections A and B of Long Branch and S ections H (UT2) and G (UT1) was gathered from a stable reac h of approximately 450 LF at the upstream end of In dian

Pot Branch. In addition to the stable section of Indian Pot Branch, composite reference reach data from four different North Carolina Coastal Plain reference sites is also used for comparison. While reference reaches can be used as an aid in designing channel dimension, pattern, and profile, there are limitations in smaller coastal plain headwater streams. The flow patterns and channel formation for most reference reach quality streams is often controlled by slope, drainage areas and large trees and other deep rooted vegetation. Some meander geometry parameters, such as radius of curvature, are particularly affected by vegetation control. Pattern ratios observed in reference reaches may not be applicable or are often adjusted in the design criteria to create more conservative designs that are less likely to erode after construction, before the permanent vegetation is established.

Collectively, the data provide valuable information regarding the range of conditions documented for similar headwater stream systems. Table 4 shows a summary of Coastal Plain reference reach data compared for single thread channels.

Table 4.

Reference Reach Parameters Used to Determine Design Ratios for Single Thread Channel

Parameter	Indian Pot Branch		Composite Reference Data from NC Coastal Plain*	
	MIN	MAX	MIN	MAX
Drainage Area, DA (sq mi)	0.68		1	19.5
Stream Type (Rosgen)	E5		E5 / C5	
Bankfull Discharge, Qbkf (cfs)	5.9		10	127
Bankfull Riffle XSEC Area, Abkf (sq ft)	6.3		7.8	95.9
Bankfull Mean Velocity, Vbkf (ft/s)	0.9		1.0	1.4
Width to Depth Ratio, W/D (ft/ft)	9.6	11.4	8	14
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	>10		4	13
Riffle Max Depth Ratio, Dmax/Dbkf	1.7	1.8	1.2	1.7
Bank Height Ratio, Dtob/Dmax (ft/ft)	1.0	1.0	1.0	1.3
Meander Length Ratio, Lm/Wbkf	5.8	9.0	11	17
Rc Ratio, Rc/Wbkf	1.1	2.9	1.5	3.0
Meander Width Ratio, Wblt/Wbkf	2.1	2.9	2.0	6.3
Sinuosity, K	1.25		1.22	1.77
Valley Slope, Sval (ft/ft)	0.003		0.0007	0.0029
Channel Slope, Schan (ft/ft)	0.0024		0.0004	0.0022
Pool Max Depth Ratio, Dmaxpool/Dbkf	1.7	2.1	1.8	2.0
Pool Width Ratio, Wpool/Wbkf	1.9	2.3	0.8	1.4
Pool-Pool Spacing Ratio, Lps/Wbkf	2.0	3.7		

***Note:** Composite reference reach information from Johannah Creek, Johnston County, NC; Panther Branch, Brunswick County, NC; Rocky Swamp, Halifax County, NC; and Beaver Dam Branch, Jones County, NC.

The upstream end of Indian Pot Branch (Section I) w here reference data was collected is classified as a Rosgen E5 stream type (Rosgen, 1996). This area shows evi dence of past disturbances primarily due to timber havest. However, cutting of timber occurred long ago and a mature canopy of vegetation exists, especially near the stream channel. The channel is geomorphically stab le and well connected with its floodplain. It also appears that the hydrology of the site was affected little by timber harvest. Indian Pot Branch flows through a Bottomland Hardwood community (described above). T his site was chosen due to its stable condition, similarity to the proposed restoration reaches, and the proximity of Indian Pot Branch to the proposed restoration reaches. Representative photographs of the reference reach are in Appendix 7.

The plant communities comprising the riparian areas of Indian Pot Branch consists of bottomland hardwo ods in the wetland areas, mesic mixed hardwoods in the adj acent uplands, and small bands of planted pine on t he eastern side of the stream corridor. The canopy la yer of the bottomland hardwoods consisted of tulip poplar, sweet gum, and red maple, with fetterbush, red bay, Chinese privet, and beauty berry comprising the sh rub layer. Herbaceous species included cinnamon fern, netted chain fern, sensitive fern (*Onoclea sensibilis*), and giant cane.

The mesic mixed hardwood areas occur upslope of the bottomland hardwoods, and contain similar canopy a nd understory species plus black cherry, southern red oak (*Quercus falcata*), loblolly pine, and sweet pepperbush. The herbaceous layer was sparse consisting mostly of bracken fern and ebony spleenwort.

Areas of planted pine consists of a monoculture of loblolly pine in the canopy layer with sweet gum an d tulip poplar in the understory. Due to a thick bed of pine straw, the herbaceous layer was very sparse consisting of an occasional bracken fern.

Soils within the reference site mapped by the NRCS are primarily Coxville fine sandy which is classifi ed as a hydric soil for the entire map unit (Figure 3).

Coxville fine sandy loam (Co) consists of poorly dr ained soil on smooth flats and in slight depression in the uplands. It occurs in areas of irregular shape. S lopes are 0 to 2 percent with slow to ponded runoff and moderate infiltration.

4.5 Determination of Credits

This report describes the proposed ecosystem restor ation approach for the Long Branch Mitigation Site and is designed specifically to meet mitigation obligation s of the 404 permit for the proposed I-73 project. As previously stated, **22,640** mitigation credits are required to offset the proj ected stream impacts. The 2010 Guidelines were used to determine the required numb er of mitigation credits and to estimate the number of mitigation credits generated by the proposed Long Branch Site.

Following is a discussion of each mitigation factor and how they were applied in calculating the credit yield for the Site. The mitigation calculation sheets can be found in Appendix 8.

Stream Type - Stream sections A, B, C, D, E, I, F, G, and H, are 1st and 2nd order Relatively Permanent Waters (RPWs) therefore were assigned a value of 0.4 in the Stream Type category of the credit calculation worksheets.

Priority Category - None of the stream sections met the definition for Primary or Secondary in the Priority Category as defined in the mitigation Guidance, and therefore they were assigned a Tertiary factor of 0.05.

Net Improvement - Net Improvement scores were calculated based on a comparison of the Low Gradient Stream Assessment Data Sheets for each stream resto ration section and the Reference Reach. Per the 201 0 mitigation Guidelines, a Low Gradient Stream Assess ment Data Sheet was prepared for the project refere nce

reach and each of the proposed stream restoration s ections. Each stream section score was subtracted f rom the reference reach score to determine a final score. The final score for each restoration section was co mpared to the chart in the Guidance to determine the net impr ovement score. This evaluation resulted in a deter mination of Significant Improvement for each restoration section, which translates to a net improvement score of 2.0 (see Table 5 below).

Table 5.
Net Improvement Factor Calculations

Section	Reference Reach Score	Section Score	Final Score	Net Improvement Value
A	16	8	8	2
B	16	7.5	8.5	2
C	16	N/A	N/A	N/A
D	16	N/A	N/A	N/A
E	16	N/A	N/A	N/A
F	16	N/A	N/A	N/A
G	16	9	7	2
H	16	9	7	2
I	16	N/A	N/A	N/A

Credit Schedule - It is anticipated that the proposed mitigation pla n will be implemented (conservation easement established, buffer enhancement, and in-st ream work) and the five-year monitoring period comp leted prior to construction of I-73, therefore a factor of 0.1 was assigned to each stream section.

Location - As previously mentioned, the I-73 alignment crosses three 8-digit HUCs and two ecoregions. The Site is located within one of the 8-digit HUC's tha t is also adjacent to the other two HUC's crossed b y the alignment. Streams within the proposed Site have si milar geomorphology and riparian buffer habitats as compared to streams impacted by I-73. Geomorphic stream characteristics observed at both the impact sites and mitigation site include low-gradients, sandy substr ates with plane beds resulting in little bed divers ity, and little to no riffle-pool development, all of which are com mon features of coastal plain streams. Riparian bu ffers are also made up of similar vegetative communities for both the mitigation site and impact sites including bottomland hardwoods, wooded swamps, freshwater mar shes, mesic-mixed hardwood forests, pine flatwoods/planted pine forests, and disturbed areas . These riparian habitats are typical for both eco regions crossed by I-73. To qualify for the Adjacent HUC Factor on the 2010 Guidelines worksheets, the mitigation site needs to be within an adjacent HUC to the project i mpacts and within the same ecoregion. However, cre dits were calculated using the Adjacent HUC (0.05) factor because:

- The stream geomorphology of the Site is similar to the streams impacted by I-73, and is typical of coastal plain streams;
- The riparian buffer habitat on the Site is similar to the riparian areas impacted by I-73, and is typi cal of both ecoregions;
- 78.25 percent of the impacts are within the same 8-digit HUC as the mitigation site;
- Both the mitigation site and the impact sites are within the Atlantic and Gulf Coastal Plain as defined in the 2008 Regional Supplement to the Corps of Engine ers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region; and,

- The remaining 21.75% of the impacts occur within adjacent 8-digit HUCs.

Riparian Buffer – Based on Chart A of the mitigation Guidance (Page 7 of 20) a 75-foot minimum buffer is required for the Site due to the adjacent agriculture and silviculture land use. All stream sections will have a minimum average buffer width of 75 feet on both sides of the streams (refer to Figure 5). Where access points are provided for property owners and the existing utility easement cross the buffers, no mitigation credit has been claimed for these areas. With the exception of the lower portion of stream Section A, a 300-foot wide conservation easement is being established along the existing channels for Sections A, B, G, and H, that are proposed for restoration (refer to Figure 7). Where Sections A, G, and H converge, credit was not claimed for the overlapping buffer areas. The dashed red line in Figure 7 indicates a 75-foot offset from the outer edge of the buffer easement and a conceptual layout of the restored stream channels that is anticipated when the restoration design is completed. In many areas the average buffer width will be twice the minimum 75-foot width. The western buffer for Section C will be a minimum of 75 feet wide and the eastern side will vary in width from approximately 20 feet near Stubbs Drive to approximately 160 feet. Sections D and a portion of Section E will have a 150-foot buffer along both sides. Only partial buffer credit was claimed for the lower portion of Section E where the stream is not the property boundary. Section F will be buffered only along the eastern edge which varies from approximately 45 feet at the pond to a maximumm of approximately 580 feet. The western side of Section F consists of wetlands and it is anticipated that this will prevent development immediately adjacent to the stream, however, no mitigation credits are claimed for this side since the property could not be secured as part of the conservation easement. The conservation easement along Section I will range in total with of approximately 350 feet at the southern end to approximately 390 feet at Bermuda Road. The minimum buffer width along the eastern side will be approximately 100 feet at one location with the remainder being approximately 150 feet wide. Enhancement of all buffers is proposed and will consist of removal and control of Chinese privet and supplemental plantings with native vegetation where appropriate. The western buffer will vary from approximately 150 to 250 feet in width. Chart B of the mitigation guidance was used to deteremine the appropriate riparian buffer factor for each section of the site. The factors used range from 0.22 to 0.34.

A summary of the buffer factors for each stream section is provided in Table 6 below. Two measurements are provided for Sections A, E, G, H, and I to account for overlap of buffers and other special conditions or buffer constraints.

Table 6.
Buffer Factor Calculations

Section	Linear Feet	Side A	Side B
A	592	0.3	0.3
	1,682	0.34	0.34
B	269	0.34	0.34
C	988	0.2	0.22
D	2,767	0.34	0.34
E	817	0.22	0
	294	0.34	0.34
F	2,506	0.22	0
G	1,118	0.34	0.34
	150	0	0
H	214	0.22	0
	150	0	0
I	1,060	0.22	0
	2,000	0.34	0.34

The mitigation credits generated by the Site are summarized in the table below.

Table 7.
Stream Mitigation Credit Estimation

Section	Length (Linear Feet)	Credit Yield
A	2,274	7,411.36
B	269	882.32
C	988	1,007.76
D	2,767	3,541.76
E	1,112	1,026.99
F	2,505	2,054.92
G	1,268	4,057.04
H	364	993.48
I	3,060	3,429.2
Totals	14,607	24,404.83

4.6 Mitigation Work Plan

The restoration concepts developed for the Site fol low a watershed approach for stream restoration des ign. Therefore, the plan takes into account the surround ing land use and management practices that could re alize additional benefit from having an adjacent restoration project in-place. The Site improvement areas are depicted on Figure 5 and the proposed restoration is shown c onceptually of Figure 7. The proposed improvements for each stream section are described in detail below.

The site contains four streams separated into multi ple reaches; Long Branch reaches A through I, India n Pot Branch reaches I and F, and two unnamed tributaries (UT1 and UT2) reaches G and H, respectively, that drain into Long Branch near the upstream end of the proje ct (Figure 5). The reaches have been subdivided in to 9 sections based on the character of the stream and t he mitigation approach to be used. Each section is described in narrative format below. Survey data of the existing conditions for Sections A, B, G, and H are in Appendix 5 and photographs of the stream mitigation sections discussed below are in Appendix 9.

All stream reaches have been impacted in the past t o differing degrees to reduce flooding and provide drainage for the adjacent fields and lands. Land use within the watershed is primarily agriculture and silvicu lture. Existing stream lengths, drainage areas, and general mitigation approach are summarized in Table 8.

Table 8.
Summary of Existing Stream Lengths and Drainage Areas

Stream	Existing Project Length (LF)	Drainage Area (acres)	General Mitigation Approach
Long Branch	7,410	1,650	Restoration and Enhancement
Indian Pot Branch	5,565	3,000	Enhancement
UT1 (Section G)	1,268	32	Restoration
UT2 (Section H)	364	33	Restoration

Section A – Long Branch

Section A of Long Branch has been deeply channelize d in the past and as such has lost connectivity wit h its floodplain. Section A also lacks bedform diversity and habitat. Existing buffer vegetation consist p rimarily of herbaceous species and a mature canopy is absent. Section A will be restored using natural channel de sign approaches to restore a single-thread, meandering c hannel. Reference reach data and past project expe rience support the design of a single-thread channel for S ection A, due to its watershed size, slope, and sed iment transport competency. The design will involve a Ro sgen Priority Level II restoration approach in whic h a new meandering single-thread channel (E stream type) wi ll be constructed through a floodplain excavated at a lower elevation. Channel dimensions and pattern will be b ased on regional curve relationships, reference rea ch information, and past project experience. In-strea m structures will consist of log and wooden structu res to enhance channel stability, and to provide improved and appropriate bedform diversity and aquatic habit ats. Figure 8 provides a conceptual layout of the propos ed in-stream structures that will be incorporated i n the construction plans. The streambanks and adjacent f loodplain areas will be planted with native vegetat ion that are moderately to highly tolerant of flooded condit ions. Figure 9 provides a conceptual view of the t ypical section that will be provided in the construction plans.

The vegetation plan for Section A will include the planting of bare-root trees in riparian buffer areas adjacent to the restored channel, from the channel banks to the conservation easement boundary. The total easemen t width through theis section is 300 feet and a minimum bu ffer width of 75 feet will be maintained with wider buffers in most areas. One 50-foot wide break in the easeme nt will be provided for the land owner to access hi s fields and no stream mitigation credits are being generated from this break (Figure 7). Tree species planted across the site will include a mixture of no less than six nat ive species that will be selected from the species list in Appendix 6.

Section B – Long Branch

Section B of Long Branch has been channelized and s traightened in the past and as such has lost connec tivity with its floodplain. Section B is currently stable but lacks in bedform diversity and habitat. The e xisting buffer vegetation is primariy herbaceous and a mature cano py is absent. Section B will be restored using nat ural channel design approaches to restore a single-threa d, meandering channel. Reference reach data and pa st project experience support the design of a single-t hread channel for Section B, due to its watershed s ize, slope, and sediment transport competency. The design will involve a Rosgen Priority Level II restoration app roach in which a new meandering single-thread channel (E str eam type) will be constructed through a floodplain excavated at a lower elevation. Channel dimension s and pattern will be based on regional curve relat ionships, reference reach information, and past project exper ience. In-stream structures will consist of log an d wooden structures to enhance channel stability, and to pro vide improved and appropriate bedform diversity and aquatic habitats. Figure 8 provides a conceptual layout of the proposed in-stream structures that will be inc orporated in

the construction plans. The streambanks and adjace nt floodplain areas will be planted with native veg etation that are moderately to highly tolerant of flooded c onditions. Figure 9 provides a conceptual view of the typical section that will be provided in the construction plans.

The vegetation plan for Section B will include the planting of bare-root trees in riparian buffer areas adjacent to the channel, from the channel banks to the conserva tion easement boundary. The total easement width t hrough this section is 300 feet and a minimum buffer widt h of 75 feet will be maintained with wider buffers in most areas. Tree species planted across the site will include a mixture of no less than six native species.

Section C – Long Branch

Section C of Long Branch has recently been logged removing almost all of the mature canopy species within the riparian buffer zone. Some mature trees still exis t along the stream banks but are sparse. Section C has been channelized and straightened in the past and as suc h has lost connectivity with its floodplain. Secti on C will be enhanced by removal of invasive exotic vegetation a long the reach and protection of the stream through a conservation easement. The existing channel condition is incised and channelized; however banks are relatively stable with mature woody vegetation, prior to loggi ng, that has helped to maintain channel stability. The understory of the riparian buffer is dominated by C hinese privet, which will be removed as part of the project. Enhancement practices will include replanting the logged easement withnative tree species, after removal of the Chinese privet, to enhance the overall riparian com munity. A minimum buffer width of 75 feet will be maintained along the western stream bank with a var ying with buffer up to 150 feet along the eastern b ank through this section.

Section D – Long Branch

Section D of Long Branch will be enhanced by remova l of invasive Chinese privet along the reach, supplemental planting of native canopy and understo ry species, and protection of the stream through a conservation easement. The existing channel condit ion is slightly incised at the upstream end of the section, becoming not incised toward the downstream half of the section with improved floodplain connection. T his area has been cutover in recent years, and as a result, few mature trees are left and the trees that are present tend to be successional species and not climax species. Chinese privet is prevalent along the reach and wi ll be removed as part of the enhancement work proposed. The riparian buffer areas along this section of channel will be cleared of invasive exotic vegetation and younge r successional species, and replanted with native h ardwood species to restore the appropriate riparian communi ty to this section of channel. The total easement width through theis section is 300 feet and a minimum bu ffer width of 150 feet will be maintained along the entire section.

Section E – Long Branch (same approach as Section D)

Section E of Long Branch will be enhanced by remova l of invasive exotic vegetation along the reach and protection of the stream through a conservation eas ement along both banks for approximately 294 LF. F or approximatelty 793 LF, the stream is not the proper ty line therefore the easement does not extend to t he stream bank. However, this section of stream will essenti ally be protected as the property owner will only h ave a narrow band of wetland between the easement and stream which will be difficult to develop. Along this section, Long Branch is not incised and is well connected wi th its floodplain, although it has been channelized and straightened in the past. Enhancement practices wi ll include supplemental planting, primarily of nati ve understory species, after removal of the Chinese pr ivet to enhance the overall riparian community. A m inimum buffer width of 150 feet will be maintained along 2 94 LF of this section. This section ends near the confluence of Long Branch and Indian Pot Branch.

Section F – Indian Pot Branch (same approach as Section D)

Section F of Indian Pot Branch will be enhanced by removal of invasive Chinese privet along the reach and protection of the stream through a conservation easement. Along this section, Indian Pot Branch has been channelized in the past but is well connected with its floodplain, with substantial wetland areas adjacent to the channel. Enhancement practices will include supplemental planting, primarily of native understory species, after removal of the exotic vegetation to enhance the overall riparian community. The buffer width will vary from a minimum of approximately 50 feet at one location to approximately 590 feet at its widest point along the left stream bank (eastern side). The conservation easement will be located only on one side because the landowner is not willing to participate in the project. Additionally, there is an existing 150-foot wide utility easement through this section that will not be included in the conservation easement. No stream mitigation credits are being generated from the utility easement since ongoing vegetation clearing for the powerlines will be required. The property line follows the existing centerline of the stream.

Sections G – Unnamed Tributary 1 (UT1)

Section G (UT1) has been channelized and straightened in the past and has lost connectivity with its floodplain. The upper end of Section G has a mature canopy buffer consisting of successional species while the lower end the buffer is completely absent. Crops are grown immediately adjacent to approximately 862 LF of the channel and the remaining 416 LF is bordered by forested areas. Coxville soils are mapped along the valley of UT1. Coxville soils are hydric soils that are also mapped along the floodplain areas of Long Branch. Section G will be restored using natural channel design approaches to restore a single-thread, meandering channel. Reference reach data and past project experience support the design of a single-thread channel for Section G, due to its watershed size, slope, and sediment transport competency. The design will involve a Rosgen Priority Level II restoration approach in which a new meandering single-thread channel (E stream type) will be constructed through a floodplain excavated at a lower elevation. Channel dimensions and pattern will be based on regional curve relationships, reference reach information, and past project experience. In-stream structures will consist of log and wooden structures to enhance channel stability, and to provide improved and appropriate bed form diversity and aquatic habitats. Figure 8 provides a conceptual layout of the proposed in-stream structures that will be incorporated in the construction plans. The streambanks and adjacent floodplain areas will be planted with native vegetation that are moderately to highly tolerant of flooded conditions. Figure 9 provides a conceptual view of the typical section that will be provided in the construction plans. The vegetation plan for Section G will include the planting of bare-root trees in riparian buffer areas adjacent to the channel, from the channel banks to the conservation easement boundary.

The total easement width through theis section is 300 feet and a minimum buffer width of 75 feet will be maintained with wider buffers in most areas. There is an existing pipe in this stream to provide the land owner access to his fields. This access will be maintained with a break in the conservation easement of approximately 25 feet. No stream mitigation credits are being generated from this portion of Section G.

Section H – Unnamed Tributary 2 (UT2)

Section H (UT2) has been channelized and straightened in the past and has lost connectivity with its floodplain. The buffer along Section H is absent and crops are grown directly adjacent to the channel andwill be restored using natural channel design approaches to restore a single-thread channel. Reference reach data and past project experience support the design of a single-thread channel for Section H, due to its watershed size, slope, and sediment transport competency. The design will involve a Rosgen Priority Level II restoration approach in which a new single-thread channel (E stream type) will be constructed through a floodplain excavated at a lower elevation. Channel dimensions and pattern will be based on regional curve relationships, reference reach information, and past project experience. In-stream structures (refer to Figure 8) will consist of a combination of log, and wooden structures to enhance channel stability, control grade, and to provide improved and

appropriate bedform diversity and aquatic habitats. The streambanks and adjacent floodplain areas wil l be planted with native vegetation that are moderately to highly tolerant of flooded conditions.

The vegetation plan for Section H will include the planting of bare-root trees in riparian buffer areas adjacent to the restored channel, from the channel banks to the conservation easement boundary. A minimum buffer width of 75 feet will be maintained with wider buffers in most areas. Tree species planted across the site will include a mixture of no less than six native species.

Section I – Indian Pot Branch (same approach as Section D)

Section I of Indian Pot Branch will be enhanced by removal of invasive Chinese privet along the reach and protection of the stream through a conservation easement. Along this section, Indian Pot Branch is stable while some evidence of past disturbance is present. Section I is well connected to its floodplain. Enhancement practices will include supplemental planting, primarily of native understory species, after removal of the exotic vegetation to enhance the overall riparian community. A minimum buffer width of 100 feet will be maintained with wider buffers in most areas.

Site Considerations

Three culverted road crossings exist along the project length and modifications are proposed at two of the crossings. The pipe in Long Branch under Hayestown Road is perched and replacement and realignment to correct the problem is proposed. The pipes in Long Branch under Stubbs Drive were recently replaced and based on the bank erosion observed in Long Branch, south of the crossing, it appears that they were not properly aligned, therefore, realignment of these pipes is also proposed. The existing pipe in Section G where access will be provided to the property aowner will be evaluated during the final design and will be replaced with a properly sized pipe to maintain the integrity of the restoration efforts. Each pipe crossing will be evaluated to determine if floodplain equalizer pipes are warranted. Additionally, the emergency access that will be provided to the property owner in Section A will consist of a permanent ford, constructed of stone, to protect the downstream restoration efforts.

4.7 Maintenance Plan

During the monitoring period, any necessary maintenance and remedial actions will be undertaken to ensure that the site meets final success criteria. If maintenance or site repairs become necessary, the level of response required will be determined, and a contractor will be secured to make the repairs. Any maintenance of remedial actions conducted will be documented in the annual monitoring reports. Once monitoring is completed and the site close out is complete, long-term maintenance and protection of the site will transfer to the long-term easement holder to protect the natural features and mitigation value of the site in perpetuity.

Maintenance requirements vary from site to site and are generally driven by the following conditions:

- Projects without established, woody floodplain vegetation are more susceptible to erosion from floods than those with a mature, hardwood forest.
- Projects with sandy, non-cohesive soils are more prone to short-term bank erosion than cohesive soils or soils with high gravel and cobble content.
- Alluvial valley channels with wide floodplains are less vulnerable than confined channels.
- Wet weather during construction can make accurate channel and floodplain excavations difficult.
- Extreme and/or frequent flooding can cause floodplain and channel erosion.
- Extreme hot, cold, wet, or dry weather during and after construction can limit vegetation growth, particularly temporary and permanent seed.
- The presence and aggressiveness of invasive species can affect the extent to which a native buffer can be established.
- Beavers could move into the restoration reaches and alter the hydrology of the site.

Maintenance issues and recommended remediation measures will be detailed and documented in monitoring reports. The conditions listed above and any other factors that may have necessitated maintenance will be discussed.

4.8 Performance Standards

The mitigation work will be monitored for a period of five years following construction. The following performance standards are proposed for the restoration and enhancement portions of the project. Monitoring methods are described in Section 4.9. For restoration, and enhancement reaches, the easement boundary will be walked yearly to document that there has been no disturbance to areas placed under conservation easement.

Bankfull Events

Two bankfull flow events must be documented within the five-year project monitoring period. The documented bankfull events must occur in separate years.

Cross-Sections

There should be little change in the as-built restoration cross-sections. If changes do take place, they will be evaluated to determine if they represent a movement toward a more unstable condition (e.g., downcutting, erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the banks, decrease in width/depth ratio). Cross-sections shall be classified using the Rosgen stream classification method and all monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type.

Visual Monitoring and Photo Reference Stations

Photographs will be used to visually evaluate channel aggradation or degradation, bank erosion, and success of riparian vegetation establishment. Photos taken along the length of the stream reaches (longitudinal photos) should indicate the absence of excessive sediment or deposition within the channel or an excessive increase in channel depth. Photos taken across the stream reaches (lateral photos) should not indicate excessive erosion or continuing degradation of the stream banks. A series of photos over time should indicate successional maturation of riparian vegetation.

Riparian Vegetation

The interim measure of vegetative success for the site will be the survival of at least 320, three-year-old planted trees per acre at the end of year three of the monitoring period. The final vegetative success criteria will be the survival of 260, trees per acre at the end of year five of the monitoring period.

4.9 Monitoring Requirements

4.9.1 Monitoring Reports

The mitigation work will be monitored for a period of five years following construction. Monitoring reports will be prepared and submitted annually. Monitoring reports will be concise and provide information to describe the site conditions and whether the mitigation project is meeting its performance standards. The report will include a narrative that provides an overview of site conditions and function; design drawings, maps, and photographs to illustrate site conditions. Monitoring will be based on geomorphic, vegetation, and photographic reviews. The easement boundaries of all reaches will be walked yearly to document that there has been no disturbance or intrusion into areas placed under conservation easement.

4.9.2 Monitoring Parameters

Riparian Vegetation Monitoring

Monitoring plots measuring 100 square meters will b e established along the project corridor to monitor the establishment of riparian buffer vegetation. The p lots will be randomly located along the restoration and enhancement reaches. The total area of the combined plots within the restoration and enhancement areas will be a minimum of 2 percent of the total planted portion of the site. The vegetation monitoring data will be collected separately for the restoration and enhancement reac hes since the enhancement reaches will receive most ly supplemental planting. An initial evaluation will be performed to verify planting methods and to dete rmine initial density. Supplemental planting will be imp lemented if necessary. Vegetation monitoring will be conducted annually in the late summer to early fall . Mortality will be determined from the difference between the previous year's living planted seedlings and th e current year's living planted seedlings. Native volunteer species will be included in the counts if found within the monitoring plots.

Photo Reference Stations

Photographs will be used to visually document resto ration success. Reference stations will be photogr aphed annually during the monitoring period. Photographs will be taken from a height of approximately five to six feet. Permanent markers will be established at eac h photo station to ensure that the same locations (and view directions) on the site are monitored in each monit oring period. Any areas of instability or concern that are observed during annual monitoring that are not loca ted at established photo points, will also be photo graphed and located for evaluation in subsequent monitoring years.

Bankfull Events

The occurrence of bankfull events within the monito ring period will be documented by the use of crest gages and photographs. The crest gages will be installed on the floodplain within 10 feet of the restored c hannels. The crest gages will record the highest watermarks between site visits, and the gages will be checked at each site visit to determine if a bankfull event has occurred . Photographs will be used to document the occurre nce of debris lines and sediment deposition on the floodplain during monitoring site visits.

Cross-sections

Two permanent cross-sections will be installed per thousand linear feet of channel along restoration reaches. No cross-sections will be established on the enhanceme nt reaches. Cross-sections will be distributed equ ally between riffles and pools. Each cross-section will be marked on both stream banks with permanent pins to establish the exact transect used. A common benchmark will be used for cross-sections and consistently used to facilitate easy comparison of year-to-year data. C ross-section surveys will be conducted annually. T he cross-section survey will include points measured at all breaks in slope, including top of bank, bankfull, i nner berm, edge of water, and thalweg, if the features are pre sent. Riffle cross-sections will be classified usi ng the Rosgen stream classification system.

Longitudinal Profile

A longitudinal profile of the thalweg will be condu cted as part of the as-built survey to collect data on the baseline conditions following restoration. The lon gitudinal profile will be detailed enough to pick u p all facet breaks between riffles, runs, pools, and glides. T he longitudinal profile will only be surveyed for r estored stream reaches as part of the as-built survey.

Visual Monitoring

Visual monitoring of all sections of the project wi ll be conducted twice per year for each of the five years of monitoring. Assessments will be undertaken of bank stability, condition of in-stream structures, chan nel

migration, headcuts, live stake mortality, impacts from invasive plant species or animal species, and condition of pools and riffles. Inspections will also include a ssessments of riparian buffer conditions. Photogra phs will be used to subjectively evaluate channel aggradation o r degradation, bank erosion, success of riparian ve getation and effectiveness of erosion control measures. Lon gitudinal photos should indicate the absence of dev eloping bars within the channel or excessive increase in ch annel depth. Lateral photos should not indicate ex cessive erosion or continuing degradation of the banks. A series of photos over time should indicate successi onal maturation of riparian vegetation.

4.10 Long-Term Management Plan

To ensure long-term protection of the mitigation pr oject, the entire Site will be placed under a conse rvation easement in perpetuity as the first primary task fo llowing the approval of the Mitigation Plan. The e asement shall be equivalent to the conservation easement template provided on the Charleston USACE District's website (refer to Appendix 4). The conservation easement w ill specify permissible activities such as hunting and other recreational uses under the restriction that are assumed to have no negative effects on the functions and values of the restored streams.

The easement will be held by a 501(c)3 organization. Both the Pee Dee Land Trust and the Nature Conservancy have expressed an interest in holding the easement, pending further review and respective internal app roval processes. The Nature Conservancy has also express ed a willingness to being the long-term land manage r responsible for implementing the long-term management needs.

4.10.1 Ownership of the Mitigation Site

It is the intent of SCDOT to purchase a portion of the Site through a fee simple purchase contract agreement and to encumber the remainder of the Site under a conse rvation easement, and perform all required work und er the Mitigation Plan. Once the restoration activities h ave met the performance criteria, SCDOT would like to transfer the fee simple title and the easement to e ither a state agency, county agency, or a 501(c)3 c onservation organization.

4.10.2 Long Term Steward – A state, county or 501(c)3 conservation organization will hold the title and the conservation easement.

4.10.3 Identification of Long Term Management Activities

Site restoration and enhancement activities are aim ed at restoring stable stream channels with connect ivity to their floodplains, restoring a diverse native vegetative community, and providing terrestrial and aquatic habitats that were altered during previous land-uses. Long- term the restoration and enhancement activities are designed to be self-supporting with minimal maintenance. Lo ng-term management activities are proposed for the Site in order to promote and protect the overall ecological functions derived from the restoration activities. Once monitoring is completed and the site is closed out, long term maintenance and protection of the site will transfer to the long-term easement holder to protect the natural features and mitigation value of the site in perpetuity, and to enforce the rules and restrictions of the conservation easement.

Once monitoring is completed and the site is closed out, long term maintenance and protection of the s ite will transfer to the long-term easement holder to protec t the natural features and mitigation value of the site in perpetuity.

4.10.4 Funding Mechanism - An escrow account will be established with sufficie nt funds to insure the continued maintenance of the Site.

4.10.5 Justification for Level of Funding - Once the state agency, county agency, or a 501(c)3 conservation organization that will hold the title and the conse rvation easement has been identified, SCDOT will ne gotiate with that entity to determine the proper level of funding to maintain the Site in perpetuity.

4.11 Adaptive Management

Principles of adaptive management are implemented a s a tool to elevate the likelihood of success of st ream mitigation projects. While ecosystem behavior and natural disturbances cannot be accurately predicted, nor can human errors always be immediately identified, adaptive management provides a process for the interactive and iterative approach to stream mitigation project assessment and on-going management.

Adaptive management involves developing measurable objectives, monitoring to determine the effectiveness of management practices, evaluation to determine wheth er the objectives are being reached, and adapting d ecision making based on the results. It is therefore imperative that site management decisions remain flexible, knowing that uncertainties exist and management action could change.

Common natural hazards that might affect successful restoration include catastrophic fire, invasive sp ecies, wind damage, droughts, and herbivory. Mistakes during plan implementation could also affect performance and function of the Site. Strategies that can be implemented at the Site in order to minimize effects from natural and human mistakes include:

- Design flaws may not be evident early in the design or construction process. If monitoring or observation indicates a potential design problem, r emediation options will be developed in conjunction with the permitting agencies.
- Construction errors will be identified with the fin al report (i.e., record drawings) which will includ e contractor as-built surveys. Any correction effort will be coordinated with permitting agencies such that the intended plan is implemented.

4.12 Financial Assurances

The Financial Assurances to ensure successful imple mentation of the Stream Mitigation Plan consist of the following components:

- The long-term management needs of the site will be addressed through the creation of a Long-Term Endowment.
- To ensure the work required under the Stream Mitiga tion Plan is performed, a performance bond sufficient to cover the work activities will be provided for during the construction phase of the project.
- To meet the equivalency requirement under the 2008 Federal Compensatory Mitigation Regulations, the Stream Mitigation Plan incorporates both short-term and long-term financial assurances: The short-term financial assurance comprises a performance bond th at covers the scope of work from mobilization through submittal of the final report; and the long -term financial assurance comprises an endowment to be established prior to the end of Monitoring Year 3 to cover easement monitoring, property management, and enforcement.

APPENDIX 1

Figure 1. Proposed I-73 Alignment

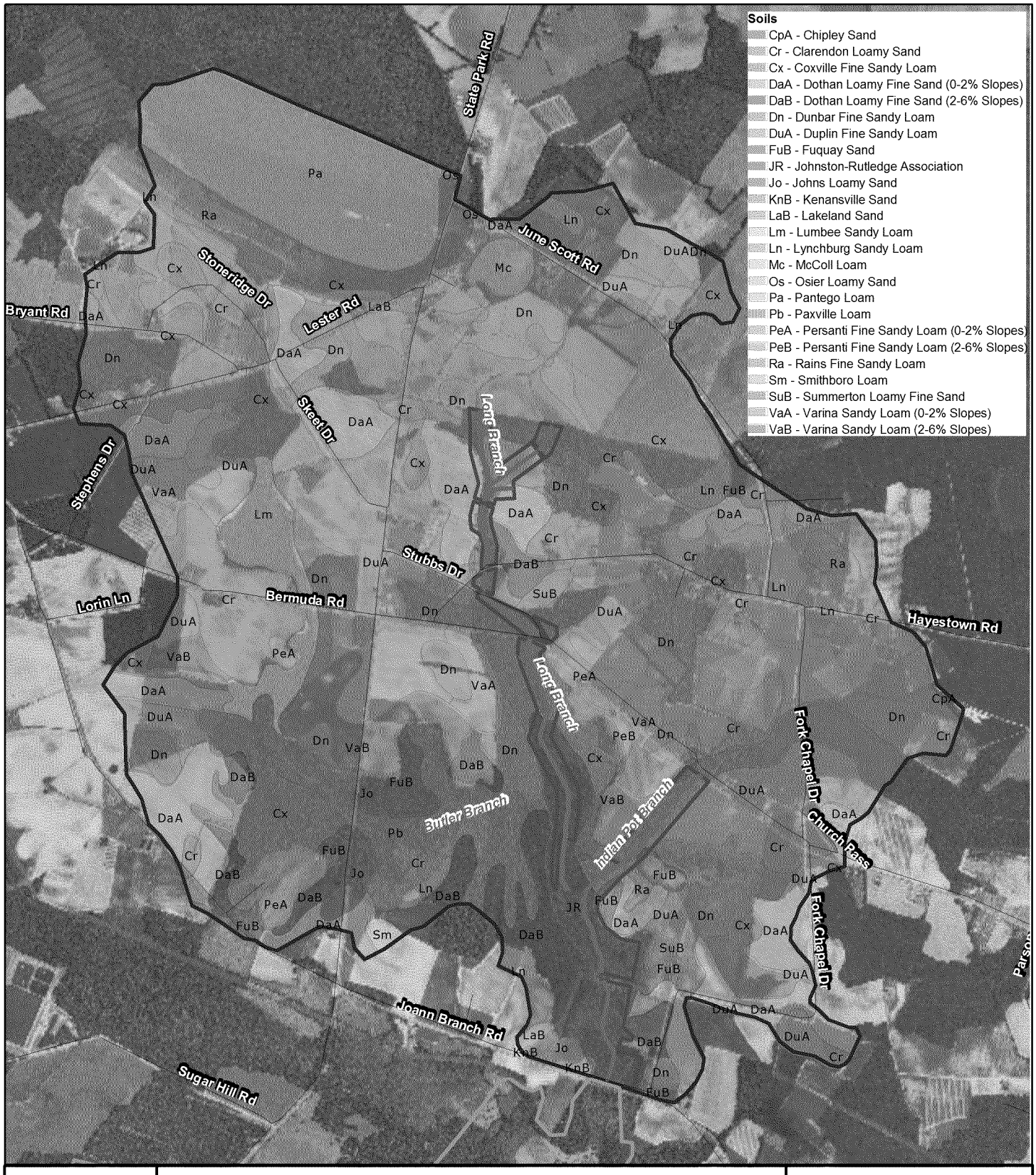
Long Branch Stream Mitigation Site
Dillon County, SC

Figure 2. Project Vicinity Map

Long Branch Stream Mitigation Site
Dillon County, SC

SCDOT

Baker



LEGEND

- Proposed Easement Boundary (~94 acres)
- Project Watershed
- Existing Streams
- State Park Boundary

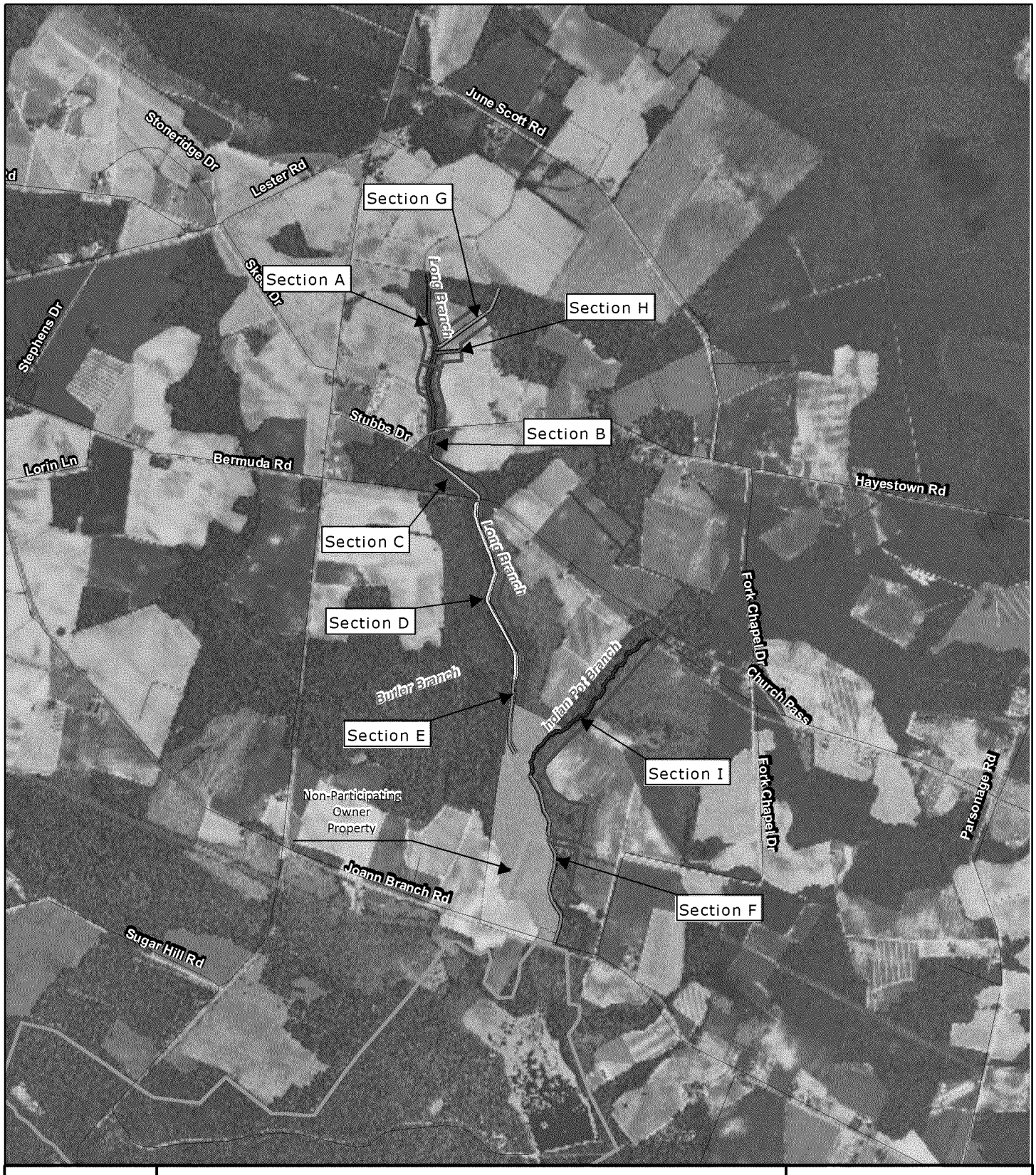
0 500 1,000 2,000 Feet

SCDOT

Figure 3. Project Watershed/Soils Map

Long Branch Stream Mitigation Site
Dillon County, SC

Baker



LEGEND

Proposed Easement Boundary (~94 acres)

State Park Boundary

Proposed Stream Sections

- A (2,274 LF)
- B (269 LF)
- C (988 LF)
- D (2,767 LF)
- E (1,112 LF)
- F (2,506 LF)
- G (1,268 LF)
- H (364 LF)
- I (3,060 LF)

0 500 1,000 2,000 Feet

SCDOT

Figure 4. Project Concept Plan

Long Branch Stream Mitigation Site
Dillon County, SC

Baker

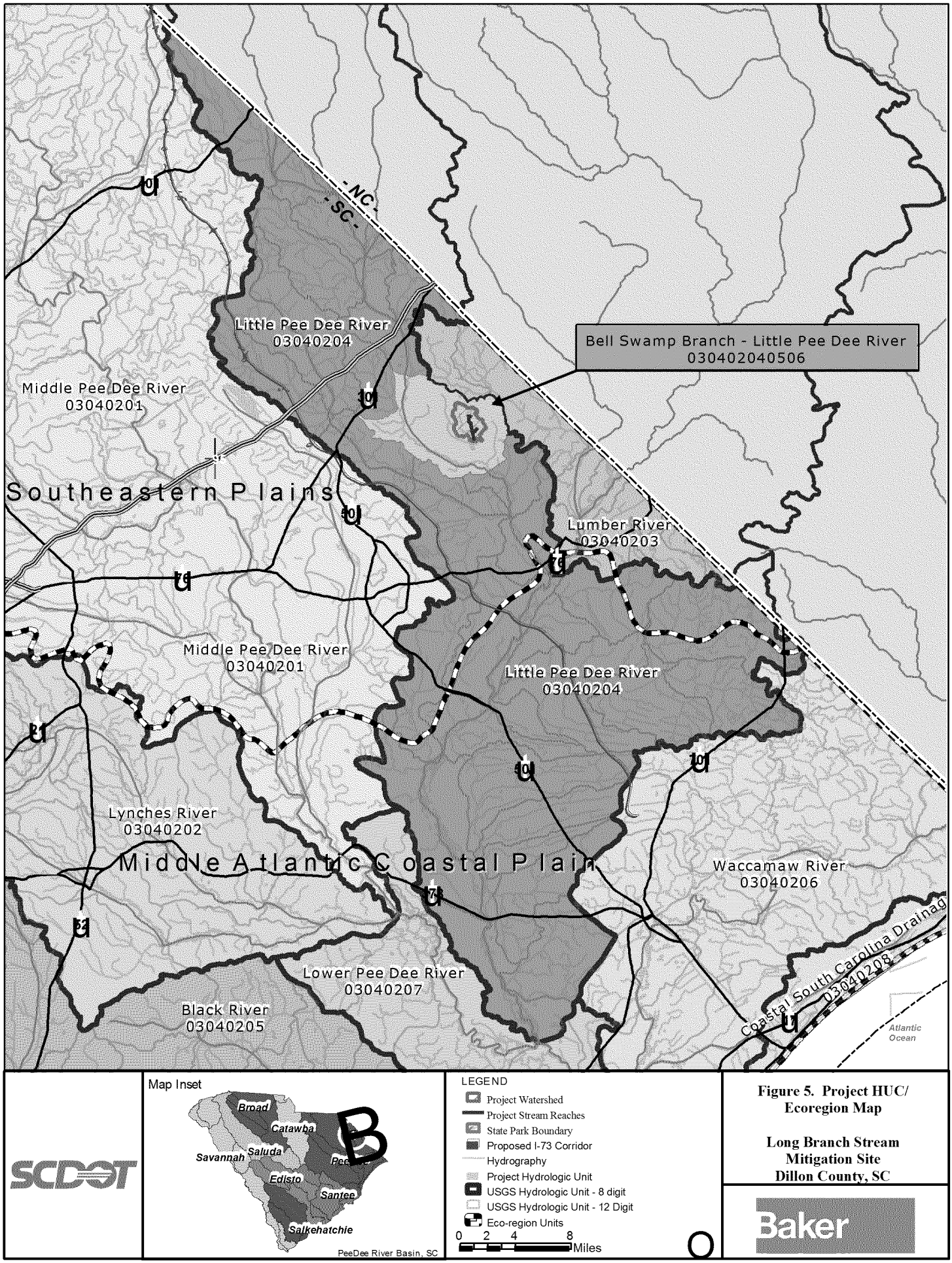
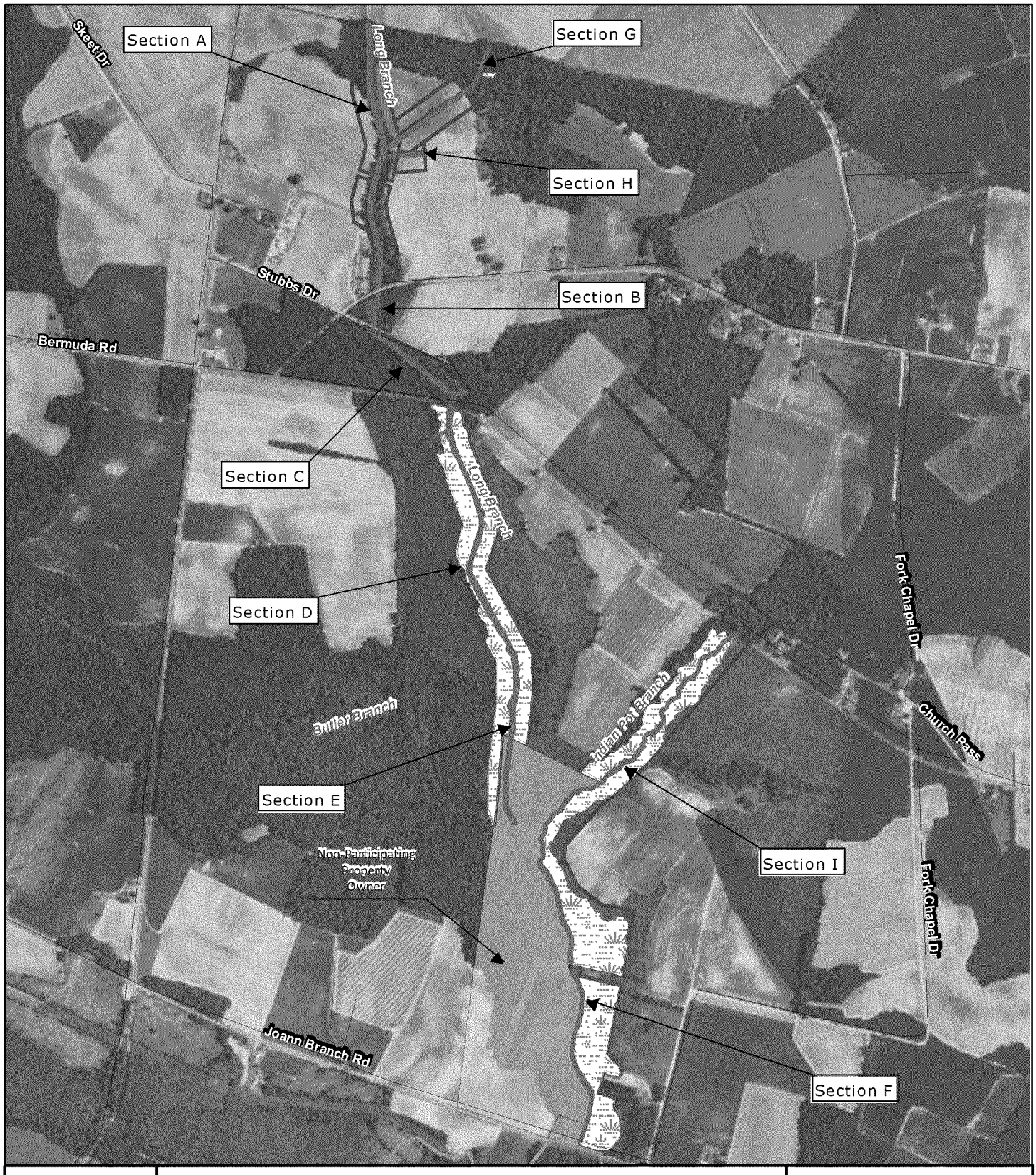


Figure 5. Project HUC/ Ecoregion Map

Long Branch Stream Mitigation Site
Dillon County, SC

SCDOT

Baker



LEGEND

Proposed Easement Boundary (~94 acres)

State Park Boundary

Wetland Delineation

Channel

Wetland

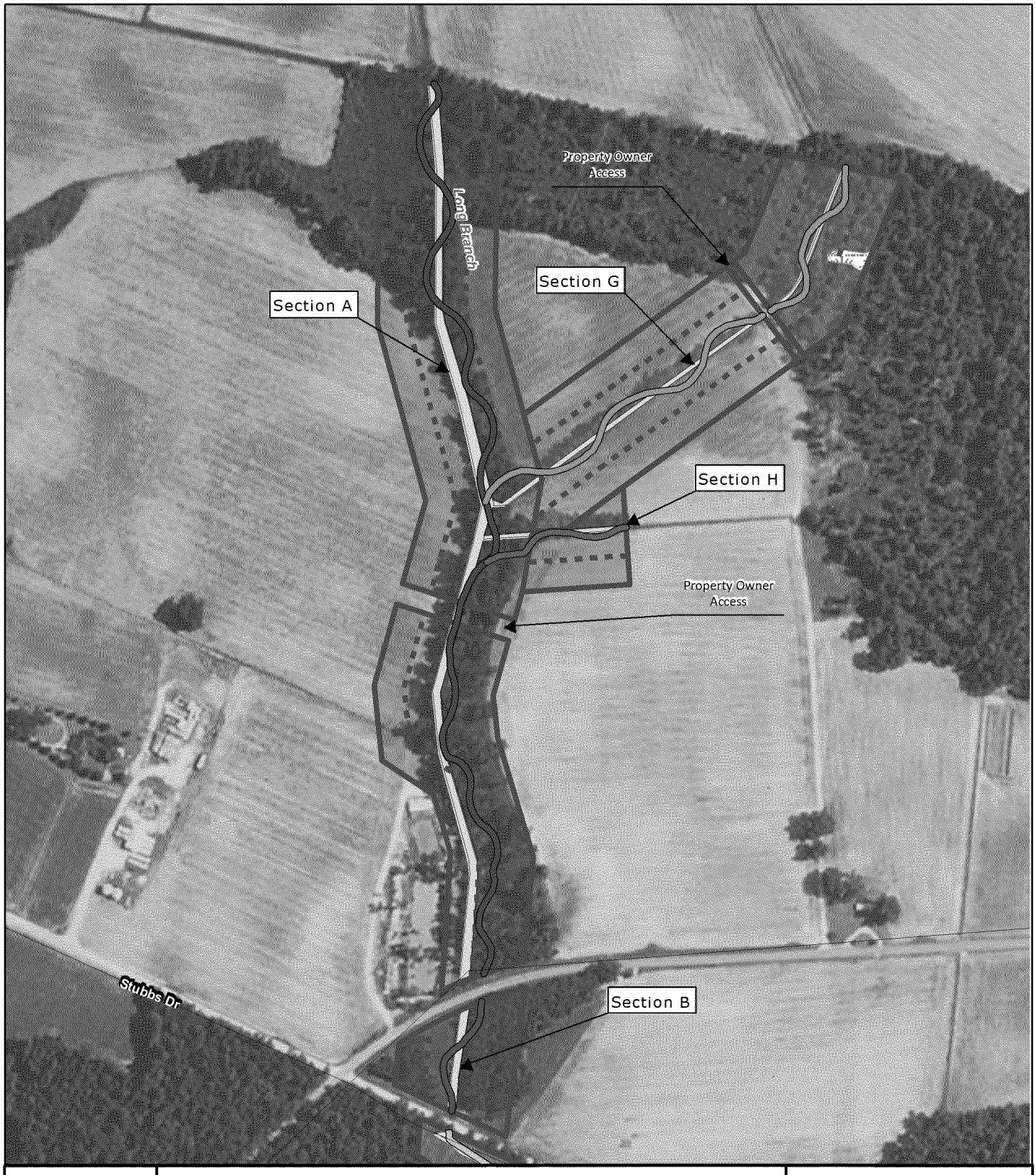
0 600 1,200 2,400 Feet

Figure 6. Project Wetland Delineation

Long Branch Stream Mitigation Site
Dillon County, SC

SCDOT

Baker



LEGEND

Easement Boundary
75 Foot Minimum Buffer
Existing Channel
Wetland

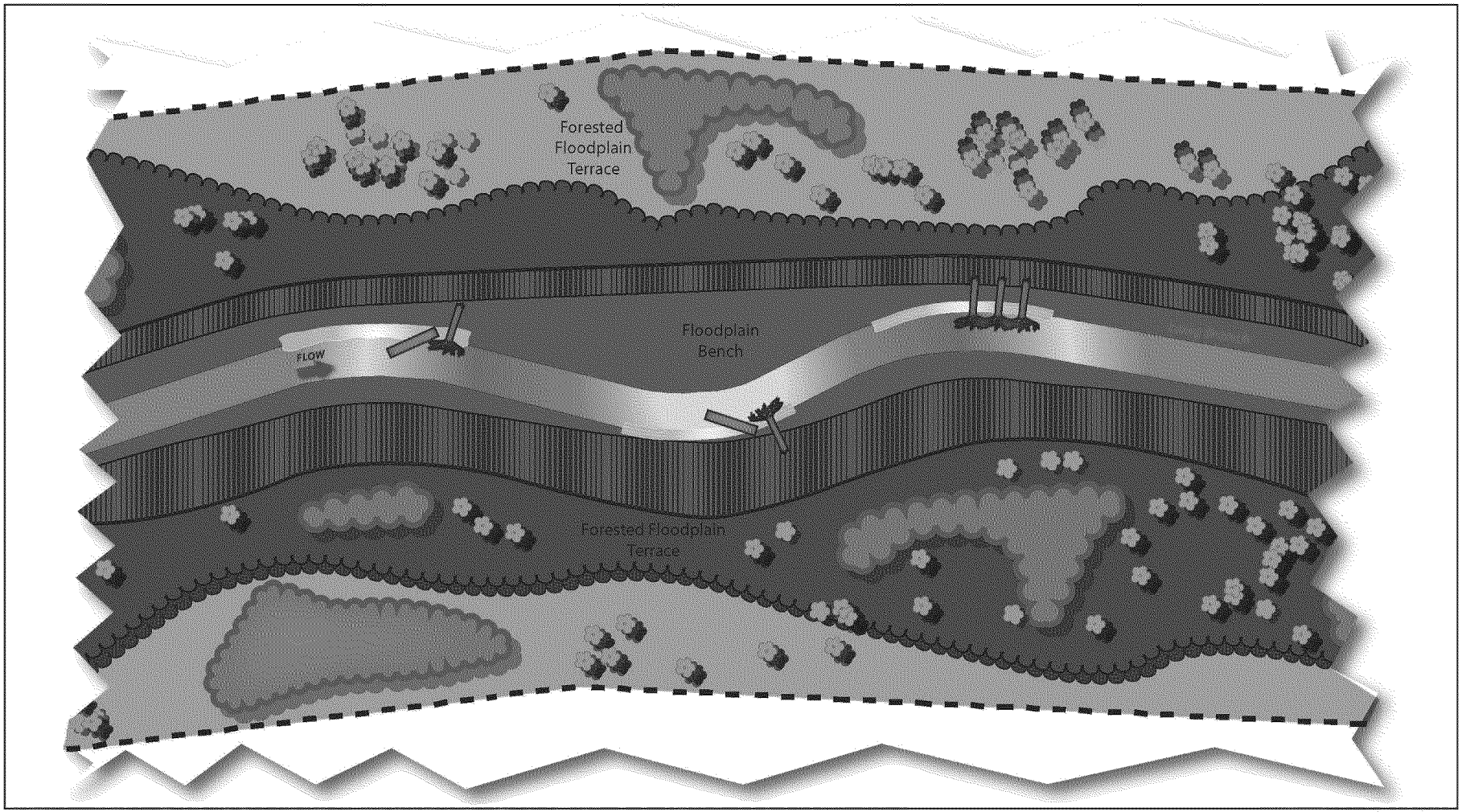
0 175 350 700 Feet

SCDOT

Figure 7. Project Concept Plan Detail

Long Branch Stream Mitigation Site
Dillon County, SC

Baker



PLANVIEW FOR PRIORITY II RESTORATION (Downstream Section A)

Note: Not to Scale

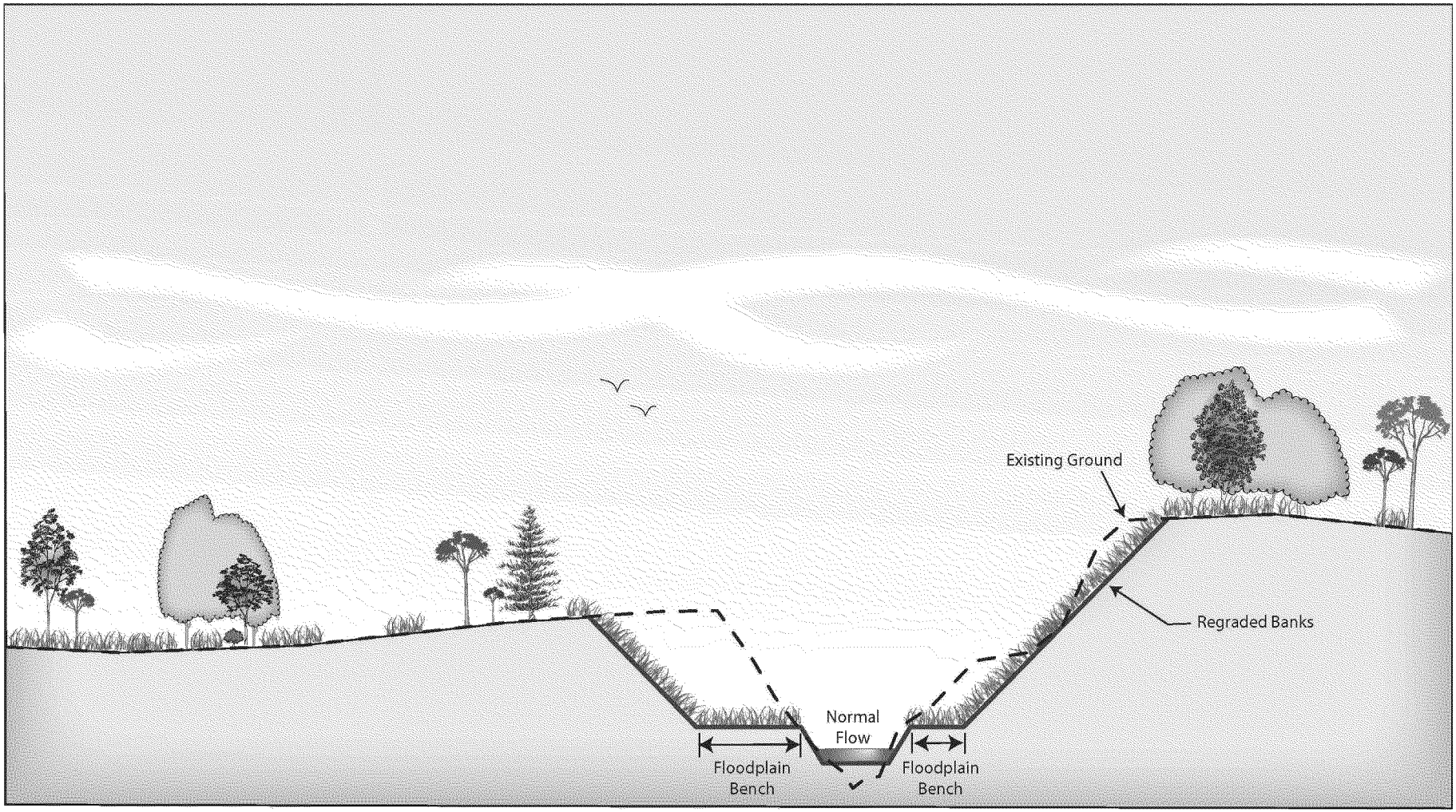
SCDOT

Forested Floodplain Terrace
Vegetated Floodplain Bankfull Bench
Low Flow Channel
Easement Boundary
Rootwad
Log Vane
Terrace Slope
Brush Mattress
Geolift
N

Figure 8. Planview

Long Branch Stream Mitigation Site
Dillon County, SC

Baker



TYPICAL RIFFLE CROSS SECTION FOR PRIORITY II RESTORATION

Note: Not to Scale

SCDOT

Figure 9. Typical Section

Long Branch Stream
Mitigation Site
Dillon County, SC

Baker

APPENDIX 2

Determination of Stream Credits
Working Draft, Subject to Change
Last Revised November 5, 2010

BRUNSON SWAMP WATERSHED

3.0 TABLES AND WORKSHEETS

ADVERSE IMPACT FACTORS FOR LINEAR SYSTEMS									
Factors	**Options**								
Stream Type[1]	Non-RPW 0.1			1st and 2nd Order RPW's 0.8			All Other Streams 0.4		
Priority Category	Tertiary 0.1			Secondary 0.4			Primary 0.6		
Existing Condition	Very Impaired 0.1		Impaired 0.5		Partially Impaired 0.75		Fully Functional 1.5		
Duration	Temporary 0.05			Recurrent 0.1			Permanent 0.3		
Dominant Impact	Shade/ Clear 0.05	Utility Crossing 0.15	Culvert 0.3	Armor 0.5	Detent-ion/Weir 0.75	Morpho-logic 1.5	Impound/ Flood 2.0	Pipe 2.2	Fill 2.5
Cumulative Impact (LF)	<50' .01	51-300' 0.10	301-500' 0.20		501-999' 0.40	1000-6000' 1.5			>6000' 3.0

[1]Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

Required Mitigation Credits Worksheet for Linear Systems

Factor	Pipe Intermittent	Impact 2	Impact 3	Impact 4	Impact 5	Impact 6
Stream Type	0.8					
Priority Category	0.1					
Existing Condition	0.5					
Duration	0.3					
Dominant Impact	2.2					
Cumulative Impact	0.1					
Sum of R Factors	R_1= **4.0**	R_2= **0.0**	R_3= **0.0**	R_4= **0**	R_5= **0**	R_6= **0**
Linear Feet Impact	LL_1= **299**	LL_2=	LL_3=	LL_4=	LL_5=	LL_6= **0**
R X LL	**1,196.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Total Required Credits = ∑ (R X LL) = 1,196

BUCK SWAMP WATERSHED

3.0 TABLES AND WORKSHEETS

ADVERSE IMPACT FACTORS FOR LINEAR SYSTEMS									
Factors	**Options**								
Stream Type[1]	Non-RPW 0.1			1st and 2nd Order RPW's 0.8			All Other Streams 0.4		
Priority Category	Tertiary 0.1			Secondary 0.4			Primary 0.6		
Existing Condition	Very Impaired 0.1		Impaired 0.5		Partially Impaired 0.75		Fully Functional 1.5		
Duration	Temporary 0.05			Recurrent 0.1			Permanent 0.3		
Dominant Impact	Shade/ Clear 0.05	Utility Crossing 0.15	Culvert 0.3	Armor 0.5	Detent-ion/Weir 0.75	Morpho-logic 1.5	Impound/ Flood 2.0	Pipe 2.2	Fill 2.5
Cumulative Impact (LF)	<50' .01	51-300' 0.10	301-500' 0.20		501-999' 0.40	1000-6000' 1.5			>6000' 3.0

[1]Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

Required Mitigation Credits Worksheet for Linear Systems

Factor	Culvert Intermittent	Culvert Intermittent	Pipe Intermittent	Culvert Perennial	Pipe Perennial	
Stream Type	0.8	0.8	0.8	0.4	0.4	
Priority Category	0.1	0.1	0.1	0.1	0.1	
Existing Condition	0.75	0.5	0.5	0.5	0.75	
Duration	0.3	0.3	0.3	0.3	0.3	
Dominant Impact	0.3	0.3	2.2	0.3	2.2	
Cumulative Impact	1.5	1.5	1.5	1.5	1.5	
Sum of R Factors	R_1= **3.8**	R_2= **3.5**	R_3= **5.4**	R_4= **3.1**	R_5= **5.3**	R_6= **0.0**
Linear Feet Impact	LL_1= **115**	LL_2= **38**	LL_3= **396**	LL_4= **72**	LL_5= **922**	LL_6=
R X LL	**431.3**	**133.0**	**2,138.4**	**223.2**	**4,840.5**	**0.0**

Total Required Credits = $\sum$ (R X LL) = **7,766**

CATFISH CREEK WATERSHED

3.0 TABLES AND WORKSHEETS

ADVERSE IMPACT FACTORS FOR LINEAR SYSTEMS									
Factors	**Options**								
Stream Type[1]	Non-RPW 0.1		1st and 2nd Order RPW's 0.8			All Other Streams 0.4			
Priority Category	Tertiary 0.1		Secondary 0.4			Primary 0.6			
Existing Condition	Very Impaired 0.1		Impaired 0.5		Partially Impaired 0.75		Fully Functional 1.5		
Duration	Temporary 0.05		Recurrent 0.1			Permanent 0.3			
Dominant Impact	Shade/ Clear 0.05	Utility Crossing 0.15	Culvert 0.3	Armor 0.5	Detent-ion/Weir 0.75	Morpho-logic 1.5	Impound/ Flood 2.0	Pipe 2.2	Fill 2.5
Cumulative Impact (LF)	<50' .01	51-300' 0.10	301-500' 0.20		501-999' 0.40	1000-6000' 1.5			>6000' 3.0

[1]Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

Required Mitigation Credits Worksheet for Linear Systems

Factor	Pipe Perennial	Pipe Perennial	Impact 3	Impact 4	Impact 5	Impact 6
Stream Type	0.4	0.4				
Priority Category	0.1	0.1				
Existing Condition	0.75	0.5				
Duration	0.3	0.3				
Dominant Impact	2.2	2.2				
Cumulative Impact	0.4	0.4				
Sum of R Factors	R_1= **4.2**	R_2= **3.9**	R_3= **0.0**	R_4= **0.0**	R_5= **0.0**	R_6= **0.0**
Linear Feet Impact	LL_1= **583**	LL_2= **120**	LL_3=	LL_4=	LL_5=	LL_6= **0**
R X LL	**2,419.5**	**468.0**	**0.0**	**0.0**	**0.0**	**0.0**

Total Required Credits = $\sum$ (R X LL) = **2,887**

Determination of Stream Credits
Working Draft, Subject to Change
Last Revised November 5, 2010

KINGSTON LAKE WATERSHED

3.0 TABLES AND WORKSHEETS

ADVERSE IMPACT FACTORS FOR LINEAR SYSTEMS									
Factors	**Options**								
Stream Type[1]	Non-RPW 0.1			1st and 2nd Order RPW's 0.8			All Other Streams 0.4		
Priority Category	Tertiary 0.1			Secondary 0.4			Primary 0.6		
Existing Condition	Very Impaired 0.1		Impaired 0.5		Partially Impaired 0.75		Fully Functional 1.5		
Duration	Temporary 0.05			Recurrent 0.1			Permanent 0.3		
Dominant Impact	Shade/ Clear 0.05	Utility Crossing 0.15	Culvert 0.3	Armor 0.5	Detent-ion/Weir 0.75	Morpho-logic 1.5	Impound/ Flood 2.0	Pipe 2.2	Fill 2.5
Cumulative Impact (LF)	<50' .01	51-300' 0.10	301-500' 0.20		501-999' 0.40	1000-6000' 1.5			>6000' 3.0

[1]Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

Required Mitigation Credits Worksheet for Linear Systems

Factor	Pipe Perennial	Impact 2	Impact 3	Impact 4	Impact 5	Impact 6
Stream Type	0.4					
Priority Category	0.1					
Existing Condition	0.75					
Duration	0.3					
Dominant Impact	2.2					
Cumulative Impact	0.2					
Sum of R Factors	R_1= **4.0**	R_2= **0.0**	R_3= **0.0**	R_4= **0.0**	R_5= **0.0**	R_6= **0.0**
Linear Feet Impact	LL_1= **307**	LL_2=	LL_3=	LL_4=	LL_5=	LL_6= **0**
R X LL	**1,212.7**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Total Required Credits = ∑ (R X LL) = **1,213**

LAKE SWAMP WATERSHED

3.0 TABLES AND WORKSHEETS

ADVERSE IMPACT FACTORS FOR LINEAR SYSTEMS									
Factors	**Options**								
Stream Type[1]	Non-RPW 0.1			1st and 2nd Order RPW's 0.8			All Other Streams 0.4		
Priority Category	Tertiary 0.1			Secondary 0.4			Primary 0.6		
Existing Condition	Very Impaired 0.1		Impaired 0.5		Partially Impaired 0.75			Fully Functional 1.5	
Duration	Temporary 0.05			Recurrent 0.1			Permanent 0.3		
Dominant Impact	Shade/ Clear 0.05	Utility Crossing 0.15	Culvert 0.3	Armor 0.5	Detent-ion/Weir 0.75	Morpho-logic 1.5	Impound/ Flood 2.0	Pipe 2.2	Fill 2.5
Cumulative Impact (LF)	<50' .01	51-300' 0.10	301-500' 0.20		501-999' 0.40	1000-6000' 1.5			>6000' 3.0

[1]Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

Required Mitigation Credits Worksheet for Linear Systems

Factor	Culvert Intermittent	Pipe Intermittent	Pipe Perennial	Impact 4	Impact 5	Impact 6
Stream Type	0.8	0.8	0.4			
Priority Category	0.1	0.1	0.1			
Existing Condition	0.5	0.75	0.75			
Duration	0.3	0.3	0.3			
Dominant Impact	0.3	2.2	2.2			
Cumulative Impact	1.5	1.5	1.5			
Sum of R Factors	R_1= **3.5**	R_2= **5.7**	R_3= **5.3**	R_4= **0.0**	R_5= **0.0**	R_6= **0.0**
Linear Feet Impact	LL_1= **39**	LL_2= **609**	LL_3= **1143**	LL_4=	LL_5=	LL_6= **0**
R X LL	**136.5**	**3,440.9**	**6,000.8**	**0.0**	**0.0**	**0.0**

Total Required Credits = ∑ (R X LL) = **9,578**

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name D 48 UT to Catfish Canal	Basin/Watershed: Catfish Creek	USGS Quad:
Latitude: 34.306117	Longitude: -79.426594	County: Dillon
Date:	Time:	Investigator: Ed Smail
Stream width: 6.0 feet	Stream Depth: 18 inches	Length of Stream Reach: 450 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	2.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.5
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.0
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	2.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ¼ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0

Total Score: 15.5 NOTES/COMMENTS:

Stream originates from pond excavated in wetlands and then flows through wetland; portions are channelized and straightened.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name D 49 UT to Catfish Canal	Basin/Watershed: Catfish Creek	USGS Quad:
Latitude: 34.306646	Longitude: -79.425343	County: Dillon
Date:	Time:	Investigator: Ed Smail
Stream width: 6 - 8 feet	Stream Depth: 18 inches	Length of Stream Reach: 583 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.5
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.0
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	2.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75

Total Score: 13.5 NOTES/COMMENTS:

Stream flows through upland forest then disperses into wetland. Portions have been channelized and straightened.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name D 63 UT to Little Reedy Creek	Basin/Watershed: Buck Swamp	USGS Quad:
Latitude: 34.395390	Longitude: -79.501524	County: Dillon
Date:	Time:	Investigator: Sanders McMillian
Stream width: 6.0 feet	Stream Depth: 3.0 feet	Length of Stream Reach: 987 linear feet
Has it rained within the past 48 hours?		Adjacent land use? (Industrial, agriculture, etc): Agriculture

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.5
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	0.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	2.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	0.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	0.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75

Total Score: 10.5 NOTES/COMMENTS:

Channelized; uniform depth and width for most of length; spoil pile along one side. Tree canopy sparse due to logging.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name M 2 UT to Catfish Canal	Basin/Watershed: Catfish Creek	USGS Quad:
Latitude: 34.295836	Longitude: -79.410192	County: Marion
Date:	Time:	Investigator: Dee Hope
Stream width: 6 - 10 feet	Stream Depth: 18 - 24 inches	Length of Stream Reach: 748 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.0
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	.75
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0

Total Score: 13.5 NOTES/COMMENTS:

Stream is shallow channel in wetland. Channel splits around upland island and then rejoins outside of road corridor. Portions are channelized and straightened.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name M 3 UT to Catfish Canal	Basin/Watershed: Catfish Creek	USGS Quad:
Latitude: 34.295107	Longitude: -79.409850	County: Marion
Date:	Time:	Investigator: Dee Hope
Stream width: 3.0 feet	Stream Depth: 4.0 feet	Length of Stream Reach: 120 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	0.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	0.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	0.50
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75

Total Score: 9 NOTES/COMMENTS:

Stream is channelized in wetland. Portion outside of wetland has been channelized and straightened. Portion in wetland "flattens" and becomes wider and shallower until discharging into main channel in wetland.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name M 10 UT to Catfish Canal	Basin/Watershed: Buck Swamp	USGS Quad:
Latitude: 34.293354	Longitude: -79.376672	County: Marion
Date:	Time:	Investigator: Ed Smail
Stream width: 4.0 feet	Stream Depth: 18 inches	Length of Stream Reach: 314 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):	

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.0
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0

Total Score: 11.5 NOTES/COMMENTS:

Stream is small channel draining into wetland.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name M 17 UT to Catfish Canal	Basin/Watershed: Buck Swamp	USGS Quad:
Latitude: 34.293583	Longitude: -79.375859	County: Marion
Date:	Time:	Investigator: Ed Smail
Stream width: 2 - 6 feet	Stream Depth: 18 to 36 inches	Length of Stream Reach: 954 linear feet
Has it rained within the past 48 hours?		Adjacent land use? (Industrial, agriculture, etc): Agriculture, Silviculture

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	0.5
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	0.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	0.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (if braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	0.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.25
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.25
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.25
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.25
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0

Total Score: 7.25 NOTES/COMMENTS:

Stream has been channelized for most of length at edge of wetland. Portion in wetland is shallower and wider.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name M 46 UT to Maidendown Swamp	Basin/Watershed: Buck Swamp	USGS Quad:
Latitude: 34.222946	Longitude: -79.308280	County: Marion
Date:	Time:	Investigator: Renee Flinchum-Bowles
Stream width: 4 to 8 feet	Stream Depth: 18 inches	Length of Stream Reach: 147 linear feet
Has it rained within the past 48 hours?		Adjacent land use? (Industrial, agriculture, etc): Agriculture

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.0
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	0.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.0
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50

Total Score: 10 NOTES/COMMENTS:

Stream has been channelized along entire length.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name M 47 UT to Maidendown Swamp	Basin/Watershed: Buck Swamp	USGS Quad:
Latitude: 34.222652	Longitude: -79.307908	County: Marion
Date:	Time:	Investigator: Ed Small
Stream width: 4 to 8 feet	Stream Depth: 18 inches to 3 feet	Length of Stream Reach: 215 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture, Silviculture	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.5
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.0
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75

Total Score: 13 NOTES/COMMENTS:

Stream has been channelized for most of length.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name M 52 UT to Maidendown Swamp	Basin/Watershed: Buck Swamp	USGS Quad:
Latitude: 34.215867	Longitude: -79.299519	County: Marion
Date:	Time:	Investigator: Ed Smail & Renee Flinchum-Bowles
Stream width: 2 - 12 feet	Stream Depth: 6 to 18 inches	Length of Stream Reach: 1,718 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.5
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.5
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.0
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (if braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0

Total Score: 15 NOTES/COMMENTS:

Channel has been excavated and straightened along portions of length. Other portions become very wide and shallow. Logging in the vicinity has removed canopy from one segment.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name M 58 UT to Maidendown Swamp	Basin/Watershed: Buck Swamp	USGS Quad:
Latitude: 34.208187	Longitude: -79.296315	County: Marion
Date:	Time:	Investigator: Renee Flinchum-Bowles
Stream width: 2 - 8 feet	Stream Depth: 6 - 18 inches	Length of Stream Reach: 248 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.0
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	0.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	0.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.25
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50

Total Score: 9.25 NOTES/COMMENTS:

Stream originates as agricultural ditch. Portion in wetland becomes very shallow and wide until dissipating in wetland. Portion is channelized and piped under farm road.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name LPDR	Basin/Watershed: Little Pee Dee River	USGS Quad:
Latitude: 34.144501	Longitude: -79.207846	County: Marion / Horry
Date:	Time:	Investigator: Ed Smail; Renee Bowles; Dee Hope
Stream width: 300 to 400 feet	Stream Depth: 3 to 8 feet	Length of Stream Reach: 650 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	2.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.5
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	2.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (if braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	0.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50

Total Score: 14.75 NOTES/COMMENTS:

Channel has been excavated around bridge piles. Embankments have riprap. Portions of embankments are mowed lawn.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name H 35 UT to Lake Swamp	Basin/Watershed: Lake Swamp	USGS Quad:
Latitude: 34.101923	Longitude: -79.151542	County: Horry
Date:	Time:	Investigator: Peter Gerace
Stream width: 3 feet	Stream Depth: 3 feet	Length of Stream Reach: 224 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.0
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	0.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	0.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.25
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.25

Total Score: 9 NOTES/COMMENTS:

Stream is channelized and straightened.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name H 43 Long Branch	Basin/Watershed: Lake Swamp	USGS Quad:
Latitude: 34.072819	Longitude: -79.138100	County: Horry
Date:	Time:	Investigator: Peter Gerace
Stream width: 3 to 6 feet	Stream Depth: 18 inches to 3 feet	Length of Stream Reach: 1,253 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.5
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.5
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.0
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0

Total Score: 15 NOTES/COMMENTS:

Stream has been channelized and straightened.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name H 50 UT to Joiner Swamp	Basin/Watershed: Lake Swamp	USGS Quad:
Latitude: 34.054664	Longitude: -79.127436	County: Horry
Date:	Time:	Investigator: Peter Gerace
Stream width: 3 to 5 feet	Stream Depth: 18 to 24 inches	Length of Stream Reach: 749 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):	

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.0
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.0
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0

Total Score: 12.75 NOTES/COMMENTS:

Stream has been channelized.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name H 59 UT to Joiner Swamp	Basin/Watershed: Lake Swamp	USGS Quad:
Latitude: 34.042426	Longitude: -79.121040	County: Horry
Date:	Time:	Investigator: Peter Gerace
Stream width: 3 to 6 feet	Stream Depth: 18 inches to 3 feet	Length of Stream Reach: 620 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture	

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	1.0
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	1.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.0
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ¼ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75

Total Score: 11.75 NOTES/COMMENTS:

Stream has been channelized.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name H 64 Joiner Swamp	Basin/Watershed: Lake Swamp	USGS Quad:
Latitude: 34.036036	Longitude: -79.118430	County: Horry
Date:	Time:	Investigator: Peter Gerace
Stream width: 6 to 12 feet	Stream Depth: 18 inches to 4 feet	Length of Stream Reach: 787 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture	

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.5
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.5
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	2.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.0
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (if braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	1.0
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0

Total Score: 14.5 NOTES/COMMENTS:

Stream has been channelized.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name H 70 UT to Loosing Swamp	Basin/Watershed: Lake Swamp	USGS Quad: 34.028488
Latitude: 34.028488	Longitude: -79.114535	County: Horry
Date:	Time:	Investigator: Peter Gerace
Stream width: 10 to 12 feet	Stream Depth: 2 to 3 feet	Length of Stream Reach: 681 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	0.5
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	2.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	0.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (if braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	0.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50

Total Score: 9.5 NOTES/COMMENTS:

Stream has been severely channelized.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name H 75 Loosing Swamp	Basin/Watershed: Lake Swamp	USGS Quad:
Latitude: 34.020173	Longitude: -79.110586	County: Horry
Date:	Time:	Investigator: Peter Gerace
Stream width: 3 to 8 feet	Stream Depth: 18 inches to 3 feet	Length of Stream Reach: 1,077 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture	

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	0.5
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	2.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	0.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	0.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50

Total Score: 9 NOTES/COMMENTS:

Stream has been severely channelized.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name H 81 Moose Swamp	Basin/Watershed: Lake Swamp	USGS Quad:
Latitude: 34.005794	Longitude: -79.096023	County: Horry
Date:	Time:	Investigator: Peter Gerace
Stream width: 2 to 3 feet	Stream Depth: 6 to 18 inches	Length of Stream Reach: 801 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):	

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.5
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	2.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	2.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	1.0

Total Score: 14 NOTES/COMMENTS:

Stream has been partially channelized.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name H 88 UT to Chinners Swamp	Basin/Watershed: Brunson Swamp	USGS Quad:
Latitude: 33.993785	Longitude: -79.080578	County: Horry
Date:	Time:	Investigator: Peter Gerace
Stream width: 3 to 4 feet	Stream Depth: 6 to 18 inches	Length of Stream Reach: 899 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	2.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	0.5
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (if braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	0.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.50
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.25
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.25

Total Score: 9 NOTES/COMMENTS:

Stream has been channelized.

LOW GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name H 105 UT to Maple Swamp	Basin/Watershed: Kingston Lake	USGS Quad:
Latitude: 33.953594	Longitude: -79.075885	County: Horry
Date:	Time:	Investigator: Peter Gerace
Stream width: 3 to 4 feet	Stream Depth: 6 to 18 inches	Length of Stream Reach: 794 linear feet
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc): Agriculture	

Habitat	Condition Category				
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired	
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.	
SCORE	2.0	1.5	1.0	0.5	1.0
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.	
SCORE	2.0	1.5	1.0	0.5	1.0
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.	
SCORE	2.0	1.5	1.0	0.5	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	2.0	1.5	1.0	0.5	1.0
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	2.0	1.5	1.0	0.5	2.0
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.	
SCORE	2.0	1.5	1.0	0.5	1.0
7.Channel Sinuosity	The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.)	The bends in the stream increase the stream length 2-3X longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	2.0	1.5	1.0	0.5	1.0
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.75
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.	
SCORE	Left Bank 1.0	0.75	0.50	0.25	0.50
SCORE	Right Bank 1.0	0.75	0.50	0.25	0.75

Total Score: 11.75 NOTES/COMMENTS:

Stream has been partially channelized.

APPENDIX 3

NOTE: In accordance with the Access and Use Agreement with the South Carolina Institute of Archaeology and Anthropology and the South Carolina Department of Archives and History, "archaeological sites and the information they produce constitute a unique and nonrenewable resource." Accordingly, maps generated using the ArchSite database have not been included in this report as they depict sensitive location data.

ARCHAEOLOGICAL SITES

Site Number	Site Name	Project	Affiliation	County	State
38DN0105				DILLON	SC
38DN0106				DILLON	SC
38DN0107				DILLON	SC
38DN0108				DILLON	SC
38DN0109				DILLON	SC
38DN0110				DILLON	SC
38DN0111				DILLON	SC
38DN0112				DILLON	SC
38DN0125				DILLON	SC

NATIONAL REGISTER POINTS

Resource	Address	City	County	Acres	Certif.	Certif. Date	Signif. Year	Signif. Level	Signif. Area
Meekins Barn	Off SC 9	Floydale	Dillon	0.2	LISTED IN THE NATIONAL REGISTER	19840803		State	Architecture
Smith Barn	E of Floydale	Floydale	Dillon	0.4	LISTED IN THE NATIONAL REGISTER	19841204	1942	State	Commerce

HISTORIC STRUCTURES

Site Number	Resource Name	NR Eligibility	Date of Resource	Address	City	County	Report Title	Notes
0482		Not Eligible	1910s	.2 mile N of the intersection of State Park Road & Joann Branch Road		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
0483		Not Eligible	1920s	703 State Park Road		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
0484		Not Eligible	1920s	688 June Scott Road		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
0485		Not Eligible	1880s	N corner of Hayestown Road & Fork Chapel Drive		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
	Hayestown Pentecostal	Not		.2 mile W of the intersection			Historic Architectural Survey of Dillon	

0486.00	Holiness Church	Eligible	1910s	of Hayestown Road & June Scott Road		Dillon	County, SC (Bailey et al 2011)	
0486.01	Hayestown Pentecostal Holiness Church	Not Eligible	1950s	.2 mile W of the intersection of Hayestown Road & June Scott Road		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
0487.00		Not Eligible	1920s	2246 Hayestown Road		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
0487.02		Not Eligible	1920s	2246 Hayestown Road		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
0487.01		Not Eligible	1920s	2246 Hayestown Road		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
0488	Bermuda Cemetery	Not Eligible	1864	the intersection of State Park Road & Lester Jackson Hwy		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
0489	Bermuda Baptist Church	Not Eligible	1910s	713 Lester Jackson Hwy		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
0717		Not Eligible	1900s	.75 mile SW of the intersection of Hayestown Road & Parsonage Road		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
0718		Not Eligible	1910s	1 mile W of the intersection of Hayestown Road & Parsonage Road		Dillon	Historic Architectural Survey of Dillon County, SC (Bailey et al 2011)	
		Not		.75 mile W of the intersection of Hayestown			Historic Architectural Survey of Dillon	

0719		Eligible	1900s	Road & Parsonage Road		Dillon	County, SC (Bailey et al 2011)

SURVEY AREAS

Survey Name	Survey Date	Agency	Consultant	Authors	Type of Survey	County	Arch Sites	AG Sites	Notes
Intensive CR Assessment of Two Proposed Telecom Towers	2003	FCC	Bland and Associates	Bland, M. and Rolland, V.	Intensive-Architectural	Dillon	0	0	No eligible sites identified

APPENDIX 4

STATE OF SOUTH CAROLINA CONSERVATION EASEMENT AND ACCEPTANCE

COUNTY OF _____

THIS INDENTURE, is made this _____ day of _____, 20____, by and between _____("Grantor(s)"), of _____, South Carolina, and _____, ("Grantee(s)"), of _____, South Carolina.

WHEREAS, Grantor is the owner in fee simple of certain real property *["real property" includes surface waters and wetlands, any interest in submerged lands, uplands, associated riparian/littoral rights*] located in _____County, South Carolina, more particularly described [*description of tract must include: 1) acreage, and 2) reference the surveyed plat(s) required below*] ("Protected Property");

WHEREAS, Grantor desires to convey to the Holder a conservation easement placing certain limitations and affirmative obligations on the Protected Property for the protection of wetlands, scenic, resource, environmental, and other values, and in order that the Protected Property shall remain substantially in its natural condition forever;

WHEREAS, Holder is qualified to hold a conservation easement, and is either
(a) a governmental body empowered to hold an interest in real property under the laws of this State or the United States; or
(b) a charitable, not-for-profit or educational corporation, association, or trust [*, qualified under § 501(c)(3) and §170 (h) of the Internal Revenue Code*], the purposes or powers of which include one or more of the purposes (a) - (d) listed below;

(a) retaining or protecting natural, scenic, or open-space aspects of real property;
(b) ensuring the availability of real property for recreational, educational, or open-space use;
(c) protecting natural resources;
(d) maintaining or enhancing air or water quality.

WHEREAS, Grantor and Holder agree that third-party rights of enforcement shall be held by the U.S. Army Corps of Engineers, Charleston District and the S.C. Department of Health and Environmental Control ("Third-Parties," to include any successor agencies), and may be exercised through the appropriate enforcement agencies of the United States and the State of South Carolina, and that these rights are in addition to, and do not limit, the rights of enforcement under Department of the Army permit number _____, or any permit or certification issued by the Third-Parties.

[Insert for approved mitigation banks: WHEREAS, the Protected Property has been approved by the Third-Parties for use as a mitigation bank, to be known as _____Mitigation Bank;]

COVENANTS, TERMS, CONDITIONS, AND RESTRICTIONS

A. PURPOSE

1. The purpose of this Conservation Easement is to ensure the Property will be preserved in a "Natural Condition", as defined herein in perpetuity and to prevent any use of the Property that will materially impair or interfere with the Conservation Values of the property (the "Purpose"). Grantor intends that this Conservation Easement will confine the use of the Property to such activities, including without limitation, those involving the restoration, enhancement, and/or preservation of aquatic resources in a manner consistent with the conservation purposes of this Conservation Easement.

2. The term "natural condition," as referenced in the preceding paragraph and other portions of this conservation easement, shall mean the condition of the property, as it exists at the time this Conservation easement is executed, as well as future restoration, enhancement, or other changes to the property that occur directly as a

result of the compensatory mitigation measures required by section 404 Permit(s) pursuant [to the Mitigation Banking Instrument [*and/or described in the Final Mitigation and Monitoring Plan*] dated, _____, 20__ ("Mitigation Plan"), the cover page and Executive Summary of which are attached as Exhibit "_," including implementation, maintenance, and monitoring activities (collectively, "Compensatory Mitigation").

3. **Baseline Documentation**. The Current Conditions (which may or may not include restoration and enhancement efforts pursuant to compensatory mitigation activities), of the Property as of the date of this Deed are further documented in a "Present Conditions Report," dated,_____, 20__ and prepared by [*preparer's name*], which report is acknowledged as accurate by Grantor and Grantee. The present conditions report includes:

(a) a current aerial photograph of the Protected Property at an appropriate scale taken as close as possible to the date the donation is made;

(b) on-site photographs taken at appropriate locations on the Protected Property, including of major natural features; and,

(c) a surveyed plat of the Protected Property showing all relevant property lines, all existing man-made structures, improvements, features, and major, distinct natural features such as waters of the United States, and shall be recorded in the RMC office for each county in which the Protected Property is situated prior to the recording of this Conservation Easement, and is recorded at [insert book and page references, county and date of recording]

(d) [etc. - insert any additional documentation which may be used to evidence the natural condition of the ` Protected Property]

The Present Conditions Report has been provided to both parties and will be used by Grantee to assure that any future changes in the use of the Property will be consistent with the terms of this Deed. However, the Present Conditions Report is not intended to preclude the use of other evidence to establish the condition of the Property as of the date of this Deed.

4. **Baseline Documentation Update**. After the completion of the compensatory mitigation activities on the protected property, Grantor, grantee, and third-parties agree that the baseline documentation can and should be updated to reflect the new conditions of the protected property. In the event that such an update is needed, grantor agrees to provide such necessary update, including photographs, narratives, and any other data needed to accurately reflect the conditions of the protected property.

5. Grantor certifies to Third Parties and Grantee that to the Grantors actual knowledge, there are no previously granted easements existing on the property that interfere or conflict with the Purpose of this Conservation Easement as evidenced by the title Report attached at "Exhibit _."

6. **Current Liens**. **[*fill in as appropriate*]** At the time of conveyance of this Easement, the Property is subject to a Mortgage or Deed of Trust, the holder of which has agreed, by separate instrument, a copy of which is attached hereto as **Exhibit __**, to subordinate its rights in the Property to the extent necessary to permit the Trust to enforce the purposes of this Easement in perpetuity and to prevent any modification or extinguishment of this Easement Deed by the exercise of any rights of the Deed of Trust holder.

NOW THEREFORE, for the foregoing consideration, and in further consideration of the restrictions, rights, and agreements herein, Grantor hereby conveys to Holder a conservation easement over the Protected Property consisting of the following:

B. PROHIBITED USES

Any activity on or use of the property inconsistent with the Purpose of this Conservation Easement and not reserved as a right of Grantor is prohibited. These Restrictions shall run with the land and be binding on Grantor's heirs, successors, administrators, assigns, lessees, or other occupiers and users, and are subject to the Reserved Rights which follow. The Following uses by Grantor, Grantee, their respective guests, agents, assigns, employees, representatives, successors, and third parties are expressly prohibited on the Property except as otherwise provided herein or unless specifically provided for in the Section 404 Permit and any amendments thereto, the Mitigation

Plan, and any easements and reservations of rights in the chain of title to the property at the time of this conveyance (as set forth on Exhibit __):

1. **General**. There shall be no filling, flooding, excavating, mining or drilling; no removal of natural materials; no dumping of materials; and, no alteration of the topography in any manner.

2. **Waters and Wetlands**. In addition to the General restrictions above, there shall be no draining, dredging, damming or impounding; no changing the grade or elevation, impairing the flow or circulation of waters, reducing the reach of waters; and, no other discharge or activity requiring a permit under applicable clean water or water pollution control laws and regulations, as amended.

3. **Trees/Vegetation**. There shall be no clearing, burning, cutting or destroying of trees or vegetation, except as expressly authorized in the Reserved Rights; there shall be no planting or introduction of non-native or exotic species of trees or vegetation.

4. **Activities**. No industrial activities, commercial activities, residential activities, or agricultural activities (including livestock grazing) shall be undertaken or allowed.

5. **Structures**. There shall be no construction, erection, or placement of buildings, billboards, or any other structures, nor any additions to existing structures.

6. **New Roads**. There shall be no construction of new roads, trails or walkways without the prior written approval of the Holder and Third-Parties, including of the manner in which they are constructed.

7. **Utilities**. There shall be no construction or placement of utilities or related facilities without the prior written approval of Holder and Third-Parties.

8. **Pest Control**. There shall be no application of pesticides or biological controls, including for problem vegetation, without prior written approval from the Holder and Third-Parties.

9. **Subdivision**. There shall be no legal or de facto division, subdivision or portioning of the property.

10. **Other Prohibitions**. Any other use of, or activity on, the Protected Property which is or may become inconsistent with the purposes of this grant, the preservation of the Protected Property substantially in its natural condition, or the protection of its environmental systems, is prohibited.

[11. *Additional, case-specific restrictions may need to be inserted*]

C. GRANTEE'S RIGHTS

To accomplish the Purpose of this Conservation Easement, Grantor, its successor and assign hereby grants and conveys the following rights to Grantee and Third Parties.

1. To preserve and protect the Conservation Values of the Property, including enforcing the terms of this Conservation Easement in order to assure the protected property remains in its "natural condition," defined herein, in perpetuity.

2. To enter upon the property at reasonable times in order to monitor compliance with and to otherwise enforce the terms of this Conservation Easement.

3. To prevent any activity on or use of the property that is inconsistent with the Purpose of this Conservation Easement and to require the restoration of such areas or features of the Property that may be damaged by any act, failure to act, or any use that is inconsistent with the Purpose of this Conservation Easement.

4. All mineral, air, and water rights necessary to protect and sustain the biological resources of the Property, provided that any exercise or sale of such rights by Grantee shall not result in conflict with the Conservation Purpose.

5. All present and future development rights allocated, implied, reserved or inherent in the properties; such rights are hereby terminated and extinguished, and may not be used or transferred to any portion of the Properties.

6. The right to enforce by means, including, without limitation, injunctive relief, the terms and conditions of this Conservation Easement.

D. GRANTOR'S RESERVED RIGHTS

Notwithstanding the foregoing Restrictions, Grantor reserves for Grantor, its heirs, successors, administrators, and assigns the following Reserved Rights, which may be exercised upon providing prior written notice to Holder and to Third-Parties, except where expressly provided otherwise:

1. **Landscape Management**. Landscaping by the Grantor to prevent severe erosion or damage to the Protected Property or portions thereof, or significant detriment to existing or permitted uses, is allowed, provided that such landscaping is generally consistent with preserving the natural condition of the Protected Property.

2. **Forest Management**. Harvesting and management of timber by Grantor is limited to the extent necessary to protect the natural environment in areas where the forest is damaged by natural forces such as fire, flood, storm, insects or infectious organisms. *[Additional language related to fire management plans may be added as necessary]* Such timber harvest and management shall be carried out in accordance with Best Management Practices approved by the South Carolina Forestry Commission or successor agency, as amended.

3. **Recreation**. Grantor reserves the right to engage in any outdoor, non-commercial recreational activities, including hunting (excluding planting or burning) and fishing, with cumulatively very small impacts, and which are consistent with the continuing natural condition of the Protected Property. No written notice required.

4. **Mineral Interests**. Grantor specifically reserves a qualified mineral interest (as defined in § 170(h)(6) of the Internal Revenue Code) in subsurface oil, gas or other minerals and the right to access such minerals. However, there shall be no extraction or removal of, or exploration for, minerals by any surface mining method, nor by any method which results in subsidence or which otherwise interferes with the continuing natural condition of the Protected Property.

5. **Road Maintenance**. Grantor reserves the right to maintain existing roads, trails or walkways. Maintenance shall be limited to: removal or pruning of dead or hazardous vegetation; application of permeable materials (e.g., sand, gravel, crushed) necessary to correct or impede erosion; grading; replacement of culverts, water control structures, or bridges; and, maintenance of roadside ditches.

6. **Vegetation, Debris, and Exotic Species Removal**. Grantor reserves the right to engage in the removal or trimming of vegetation downed or damaged due to natural disaster, removal of man-made debris, removal of parasitic vegetation (as it relates to the health of the host plant) and removal of non-native or exotic plant or animal species.

7. **Compensatory Mitigation**. Grantor reserves the right to perform any restoration, enhancement, and other wetland mitigation activities required by Section 404 permit's and/or Mitigation Banking Instruments, including the use of all equipment necessary to successfully complete any mitigation requirements contained therein.

8. **Other Reserved Rights**. Grantor reserves the right to engage in all acts or uses not prohibited by the Restrictions, and which are not inconsistent with the conservation purposes of this grant, the preservation of the Protected Property in its natural condition, and the protection of its environmental systems.

9. [*Insert for approved mitigation banks: 7. Grantor reserves the sole and unrestricted right to sell credits or other entitlements or interests in the Protected Property in order to perfect and carry out the purpose of a mitigation bank.*]

10. [Additional, *case-specific reservations may be listed, e.g., fire or wildlife management plans.*]

E. GENERAL PROVISIONS

The following General Provisions shall be binding upon, and inure to the benefit of, the Grantor, Holder and Third-Parties, and the heirs, successors, administrators, assigns, lessees, licensees and agents of each:

1. **Marking of Property.** Grantor shall install and maintain permanent signs saying "Protected Natural Area" or establish an equivalent, permanent, marking system along the boundary of any protected areas such as upland buffers, riparian zones, and aquatic resources.

2. **Rights of Access and Entry**. Holder and Third-Parties shall have the right to enter and go upon the Protected Property for purposes of inspection, and to take actions necessary to verify compliance with the Restrictions. Holder shall also have the rights of visual access and view, and to enter and go upon the Protected Property for purposes of making scientific or educational observations and studies, and taking samples, in such a manner as will not disturb the quiet enjoyment of the Protected Property by Grantor. No right of access or entry by the general public to any portion of the Protected Property is conveyed by this Conservation Easement.

3. **Enforcement**. In the event of a breach of the Restrictions by Grantor or another party, the Holder or one of the Third-Parties must notify the Grantor in writing of the breach. The Grantor shall have thirty (30) days after receipt of such notice to undertake actions that are reasonably calculated to swiftly correct the conditions constituting the breach. If the Grantor fails to take such corrective action within thirty (30) days, or fails to complete the necessary corrective action, the Holder and/or the Third-Parties may undertake such actions, including legal proceedings, as are necessary to effect such corrective action. Among other relief, Holder and/or Third-Parties shall be entitled to a complete restoration for any breach of the Restrictions. Breaches of General Provisions of this Conservation Easement shall be actionable without notice. The costs of a breach, correction or restoration, including the Holder's expenses, court costs, and attorneys' fees, shall be paid by Grantor, provided Grantor is determined to be responsible for the breach. Enforcement shall be at the discretion of the Holder and/or Third-Parties, and no omission or delay in acting shall constitute a waiver of any enforcement right. These enforcement rights are in addition to, and shall not limit, enforcement rights available under other provisions of law or equity, or under any applicable permit or certification.

4. **Events Beyond Grantor's Control**. Nothing herein shall be construed to authorize the Holder or Third-Parties to institute any proceedings against Grantor for any changes to the Protected Property caused by acts of God or circumstances beyond the Grantor's control such as earthquake, fire, flood, storm, war, civil disturbance, strike, the unauthorized acts of third persons, or similar causes.

5. **Obligations of Ownership**. Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Protected Property. Grantor shall keep the Protected Property free of any liens or other encumbrances for obligations incurred by Grantor. Holder shall not be responsible for any costs or liability of any kind related to the ownership, operation, insurance, upkeep, or maintenance of the Protected Property, except as expressly provided herein. Nothing herein shall relieve the Grantor of the obligation to comply with federal, state or local laws, regulations and permits which may apply to the exercise of the Reserved Rights.

6. **Long Term Management**. Grantor will accomplish the long-term management activities identified in the approved mitigation plan, dated _____. The required activities include but are not limited to *management activities (i.e., control of invasive species, fire, etc) and the maintenance and/or replacement of structures (fences,*

ditch plugs, weirs, etc) that are critical to the long-term success of the mitigation activities as described in the approved mitigation plan.

7. **Extinguishment**. In the event that changed conditions render impossible the continued use of the Protected Property for the conservation purposes, this Conservation Easement may only be extinguished, in whole or in part, by judicial proceeding.

8. **Eminent Domain**. Whenever all or part of the Protected Property is taken in the exercise of eminent domain so as to substantially abrogate the Restrictions imposed by this Conservation Easement, the Grantor and Holder shall join in appropriate actions at the time of such taking to recover the full value of the taking, and all incidental and direct damages due to the taking.

9. **Proceeds**. This Conservation Easement constitutes a real property interest immediately vested in Holder. In the event that all or a portion of this Protected Property is sold, exchanged, or involuntarily converted following an extinguishment or the exercise of eminent domain, Holder shall be entitled to the fair market value of this Conservation Easement. The parties stipulate that the fair market value of this Conservation Easement shall be determined by multiplying the fair market value of the Protected Property unencumbered by this Conservation Easement (minus any increase in value after the date of this grant attributable to improvements) by the ratio of the value of this easement at the time of this grant to the value of the Protected Property (without deduction for the value of this Conservation Easement) at the time of this grant. The values at the time of this grant shall be the values used, or which would have been used, to calculate a deduction for federal income tax purposes, pursuant to Section 170(h) of the Internal Revenue Code (whether eligible or ineligible for such a deduction). Holder shall use its share of the proceeds in a manner consistent with the purposes of this Conservation Easement.

10. **Notification**. Any notice, request for approval, or other communication required under this Conservation Easement shall be sent by registered or certified mail, postage prepaid, to the following addresses (or such address as may be hereafter specified by notice pursuant to this paragraph):

To Grantor: _____
_____
_____

To Holder: _____
_____
_____

To Third Parties: U.S. Army Corps of Engineers
Attn: Regulatory Division
69A Hagood Avenue
Charleston, South Carolina 29403

_____
_____
_____

9. **Assignment**. This Conservation Easement is transferable, but only to a qualified holder under 501 (C)(3) and § 170(h) of the Internal Revenue Code as described herein. As a condition of such transfer, the transferee shall agree to all of the restrictions, rights, and provisions herein, and to continue to carry out the purposes of this Conservation Easement. Assignments shall be accomplished by amendment of this Conservation Easement under paragraph 12. Grantee shall notify Third Parties at least 60 days prior to any such assignment or transfer.

10. **Failure of Holder**. If at any time Grantee is unable or fails to enforce this Conservation Easement, or if Grantee ceases to be a qualified holder under §501(c)(3) and § 170(h) of the Internal Revenue Code, and if within a reasonable period of time after the occurrence of one of these events the Grantee fails to make an assignment pursuant to paragraph 9, then the Holder's interest shall become vested in another qualified holder in accordance with an appropriate (e.g., cy pres) proceeding in a court of competent jurisdiction.

11. **Subsequent Transfer**. Grantor agrees to incorporate the terms of this Conservation Easement in any deed or other legal instrument which transfers any interest in all or a portion of the Protected Property. Grantor agrees to provide written notice of such transfer to Grantee and Third Parties at least 60 days prior to the date of transfer. The

failure of Grantor to comply with this paragraph shall not impair the validity or enforceability of this Conservation Easement.

12. **Amendment**. This Conservation Easement may be amended, but only in writing signed by all parties hereto, and provided such amendment does not affect the purpose of this Conservation Easement or the status of the Grantee under any applicable laws, including S.C. Code Title 7, Chapter. Any amendments must be consistent with the conservation purposes of this grant.

13. **Severability**. Should any separable part of this Conservation Easement be found void or unenforceable by a court of competent jurisdiction, the remainder shall continue in full force and effect.

14. **Warranty**. Grantor warrants that it owns the Protected Property in fee simple, and that Grantor either owns all interests in the Protected Property which may be impaired by the granting of this Conservation Easement or that there are no outstanding mortgages, tax liens, encumbrances, or other interests in the Protected Property which have not been expressly subordinated to this Conservation Easement. Grantor further warrants that Holder shall have the use of and enjoy all the benefits derived from and arising out of this Conservation Easement.

15. **Habendum Clause**. To have and to hold, this Easement together with all and singular the appurtenances and privileges belonging or in any way pertaining thereto, either in law or equity, either in possession or expectancy, for the proper use and benefit of the Grantee, its successors and assigns, forever.

[Signature Pages Attached]

IN WITNESS WHEREOF, Grantor and Grantee have executed this Conservation Easement, and the Third-Parties have approved this Conservation Easement, on the date written above. By its execution and acceptance of this Conservation Easement, Grantee accepts the third-party rights of enforcement herein.

SIGNED, SEALED AND
DELIVERED IN THE PRESENCE OF:

GRANTOR:

_____ Signature: _____
(Witness)

_____ _____
(Witness) [type/print name of grantor]

STATE OF SOUTH CAROLINA)
) ss.
COUNTY OF _____)

I, a Notary Public, do hereby certify that _____personally appeared before me this day and acknowledged the due execution of the foregoing instrument.

WITNESS my hand and seal this _____ day of _____, 20____.

_____(S
ignature of Notary Public)

_____
(Typed/Printed name of Notary Public)

NOTARY PUBLIC FOR SOUTH CAROLINA
My Commission Expires: _____

Continuation of Signature Page
For Deed of Conservation Easement

GRANTEE:

_____ Signature: _____
(Witness)

_____ _____
(Witness) [type/print name of grantee]

_____
[Title and Organization]

STATE OF SOUTH CAROLINA)
) ss.
COUNTY OF _____)

I, a Notary Public, do hereby certify that _____personally appeared before me this day and acknowledged the due execution of the foregoing instrument.

WITNESS my hand and seal this _____ day of _____, 20____.

_____
(Signature of Notary Public)

_____
(Typed/Printed name of Notary Public)

NOTARY PUBLIC FOR SOUTH CAROLINA
My Commission Expires: _____

Approval by Third-Parties

U.S. Army Corps of Engineers,
Charleston District,

By: _____

_____
[type/print name]

Title: _____

S.C. Department of Health and
Environmental Control

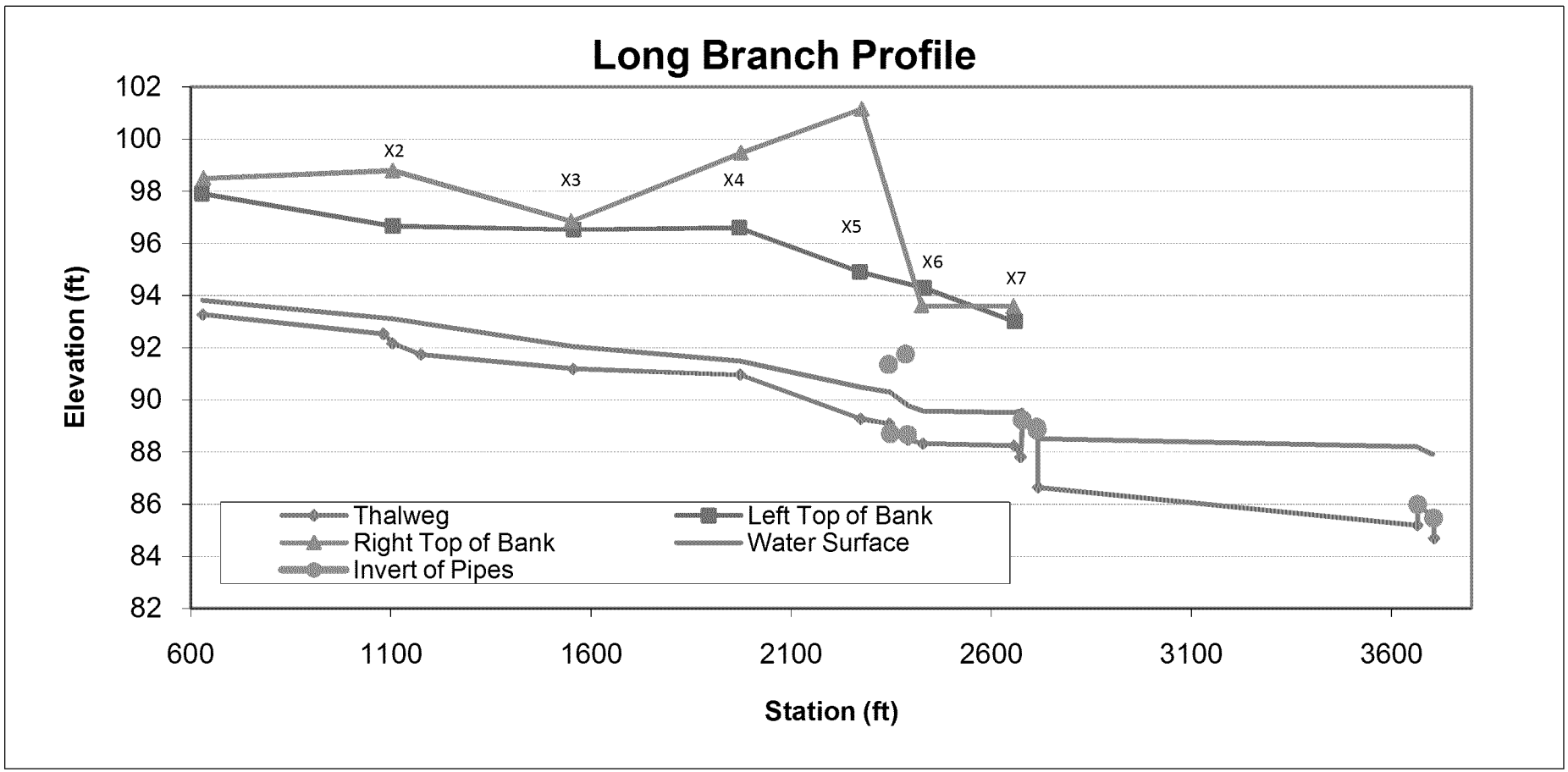
By: _____

_____
[type/print name]

Title: _____

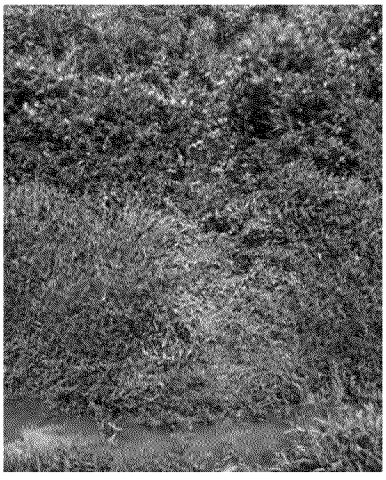
APPENDIX 5


N
X1
X2
X3
X4
X5
X6
X7
X8
X9
X-10
X-11
Hayestown Road
Stubbs Drive
Bermuda Road
0
350
700
Feet

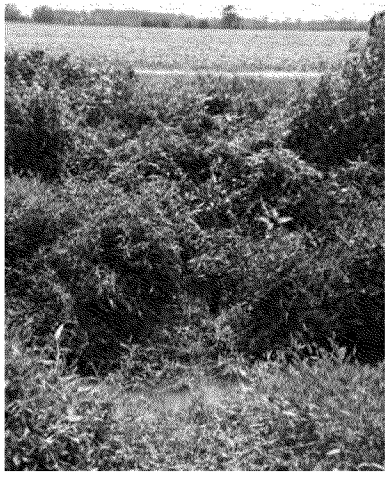

Long Branch Profile
Elevation (ft)
102
100
98
96
94
92
90
88
86
84
82
X2
X3
X4
X5
X6
X7
Thalweg
Left Top of Bank
Right Top of Bank
Water Surface
Invert of Pipes
600
1100
1600
2100
2600
3100
3600
Station (ft)

Cross-section #1

(collected June 2011)

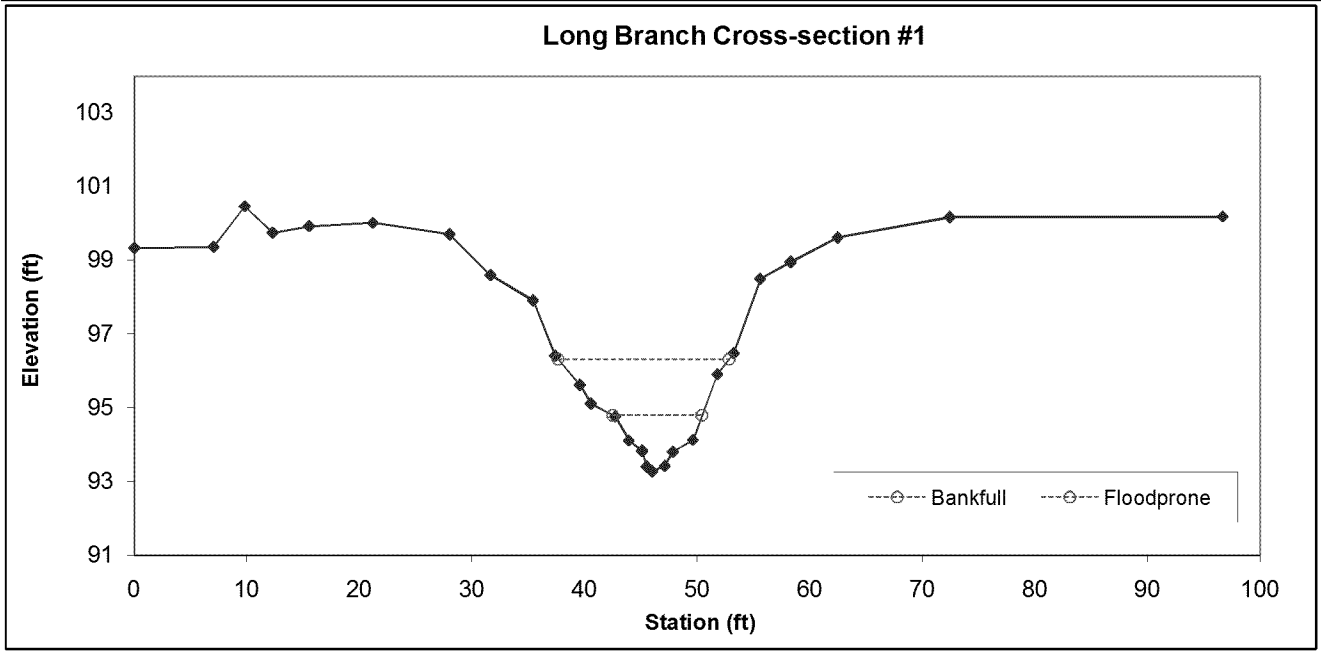


Looking at the Left Bank



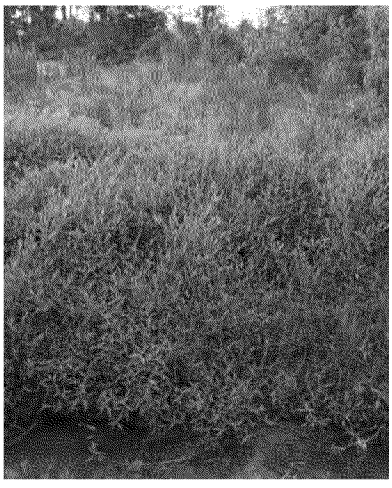
Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Bc	6.8	7.91	0.86	1.52	9.16	3	1.9	94.8	97.91

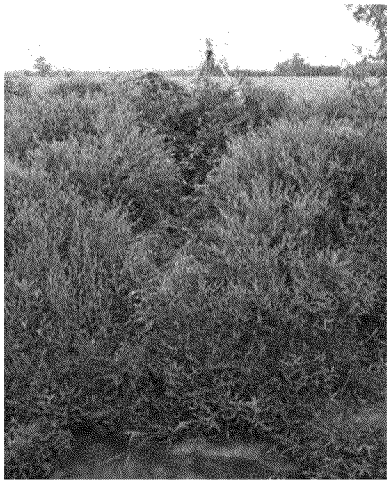


Cross-section #2

(collected June 2011)

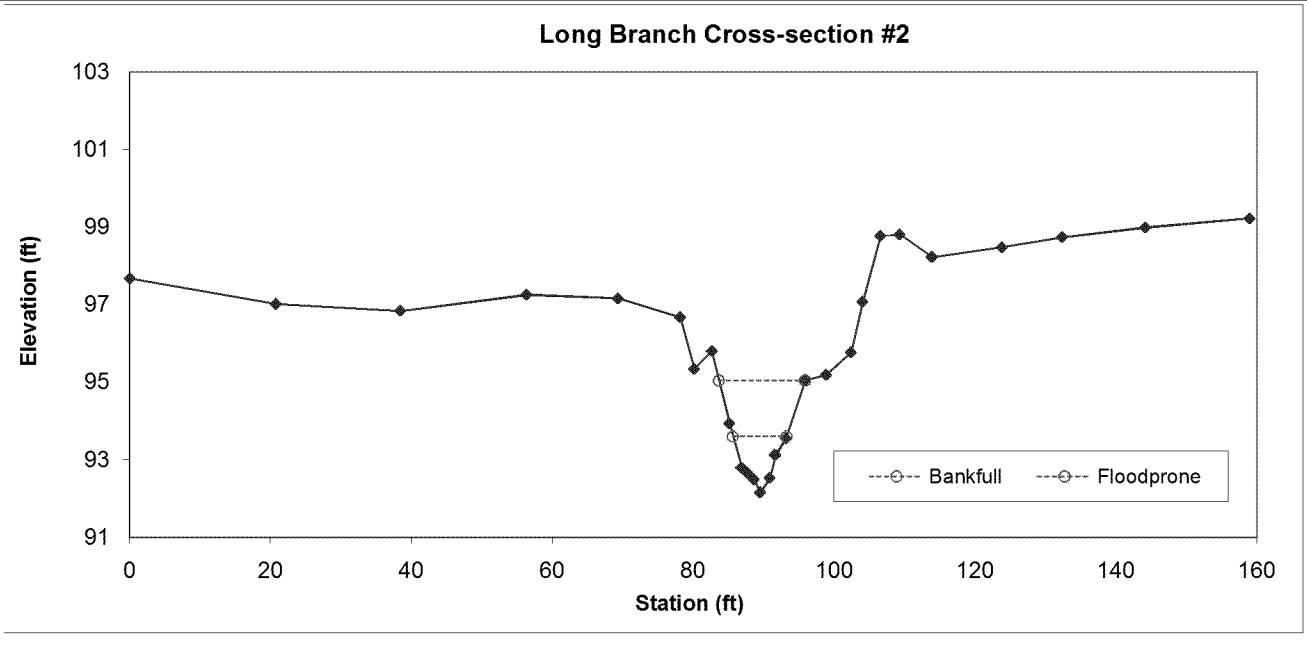


Looking at the Left Bank



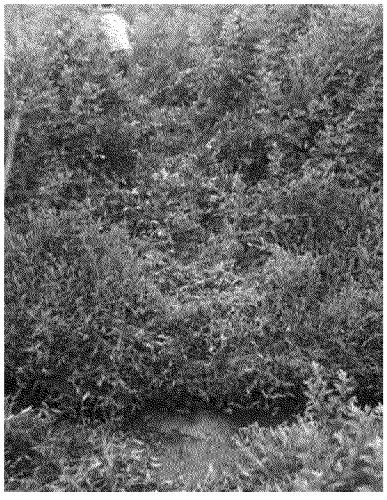
Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	G	6	7.62	0.79	1.44	9.68	3.1	1.6	93.6	96.67

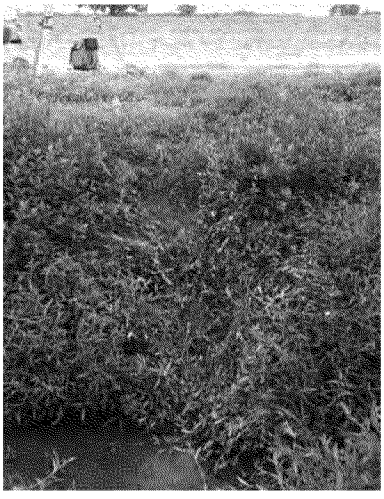


Cross-section #3

(collected June 2011)

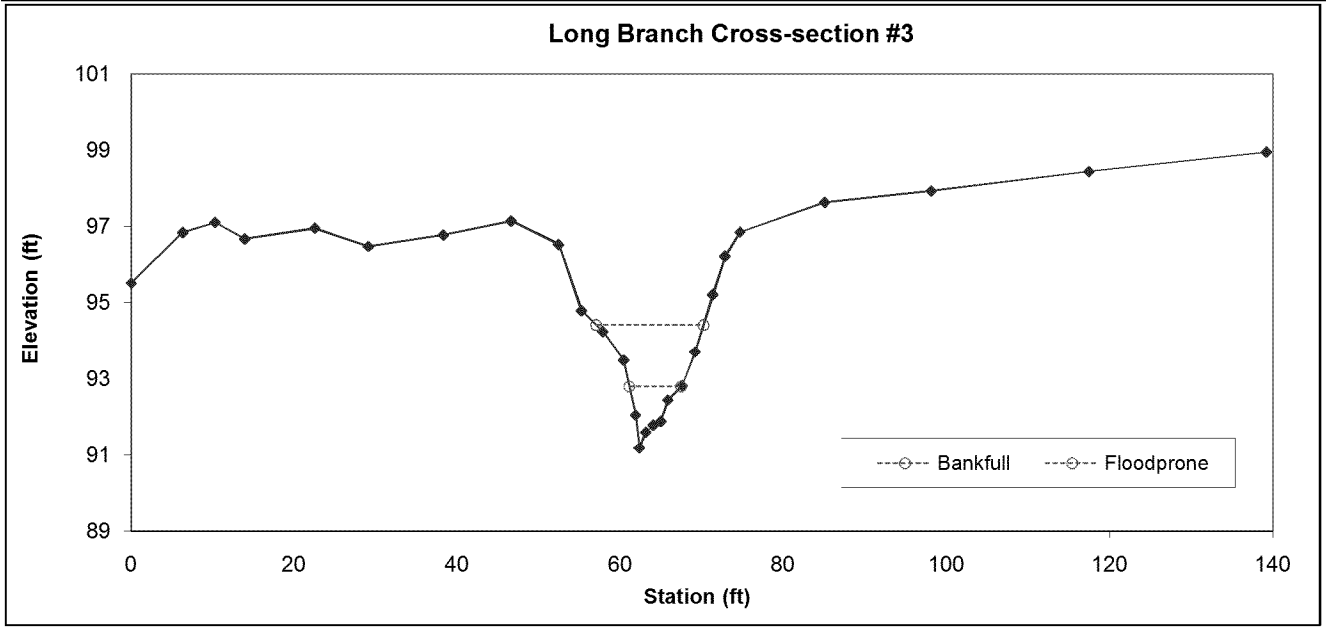


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Bc	4.7	6.31	0.74	1.61	8.51	3.3	2.1	92.8	96.53



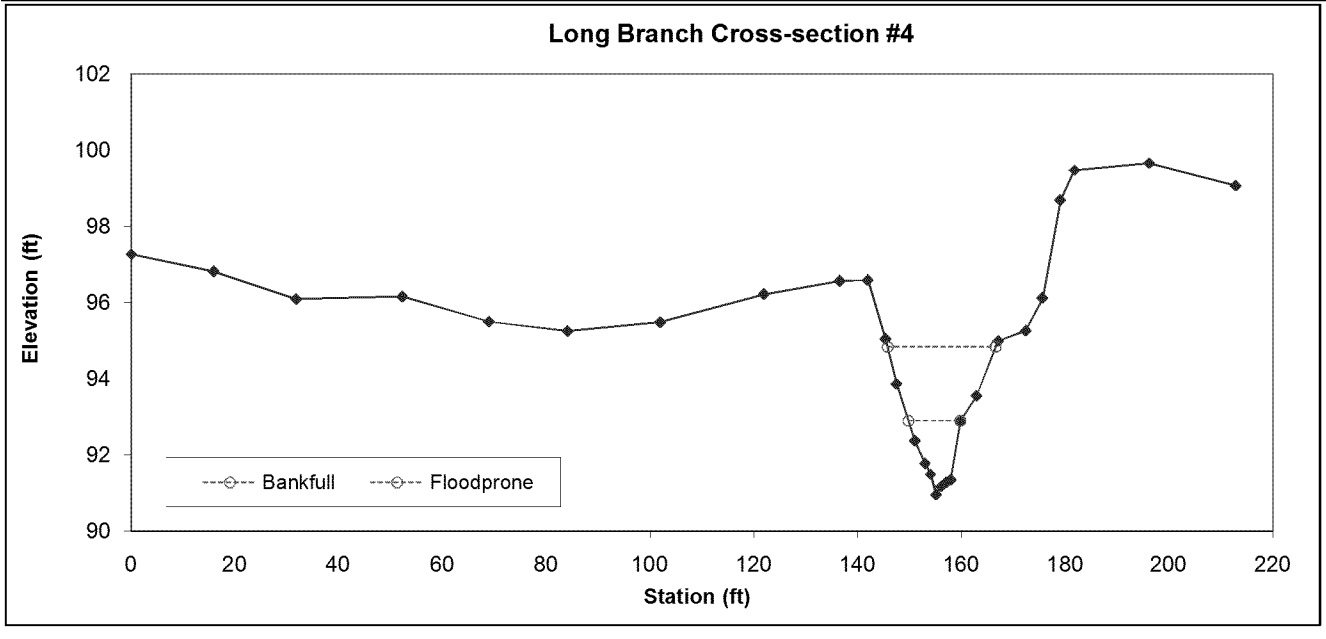
Cross-section #4

(collected June 2011)

Looking at the Left Bank

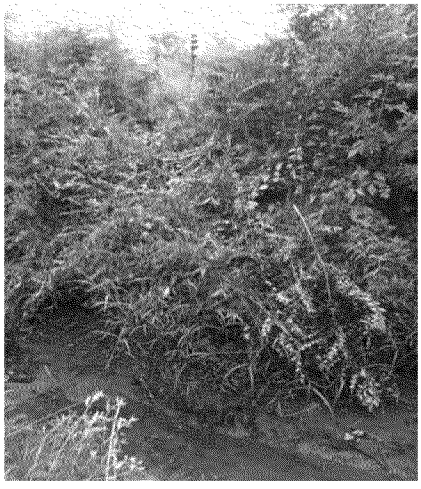
Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Bc	11.2	10.02	1.12	1.94	8.95	2.9	2.1	92.9	96.6



Cross-section #5

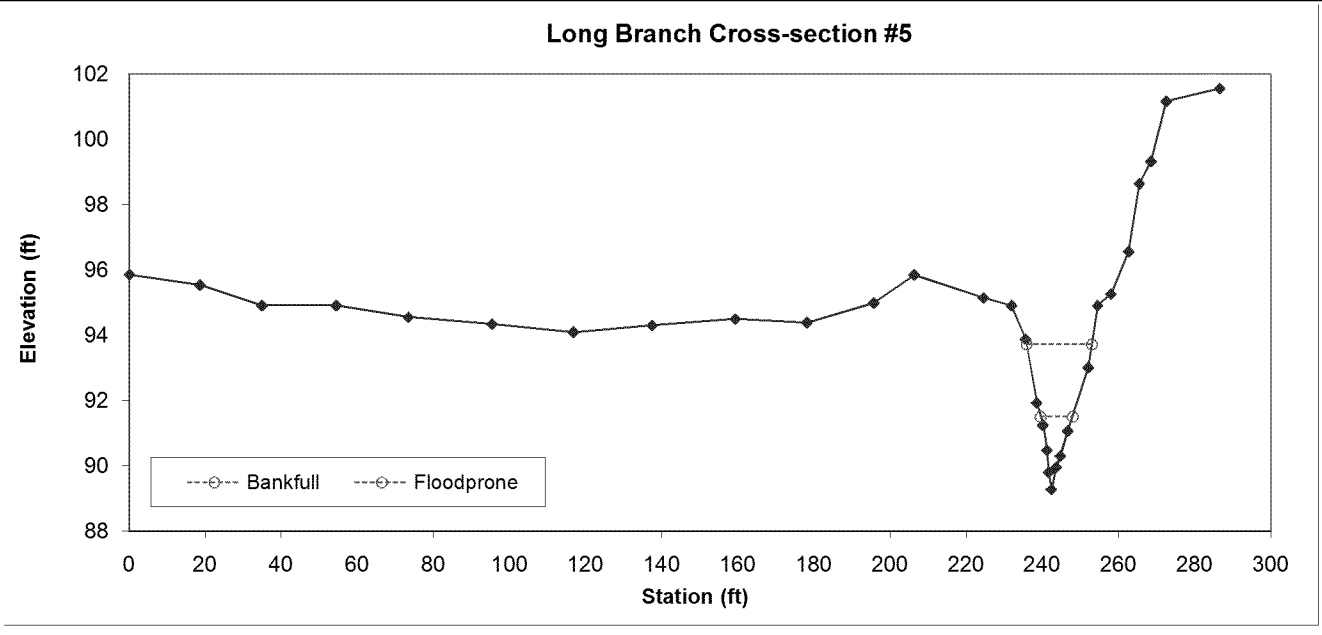
(collected June 2011)



Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Bc	8.5	8.39	1.01	2.22	8.32	2.5	2	91.5	94.91



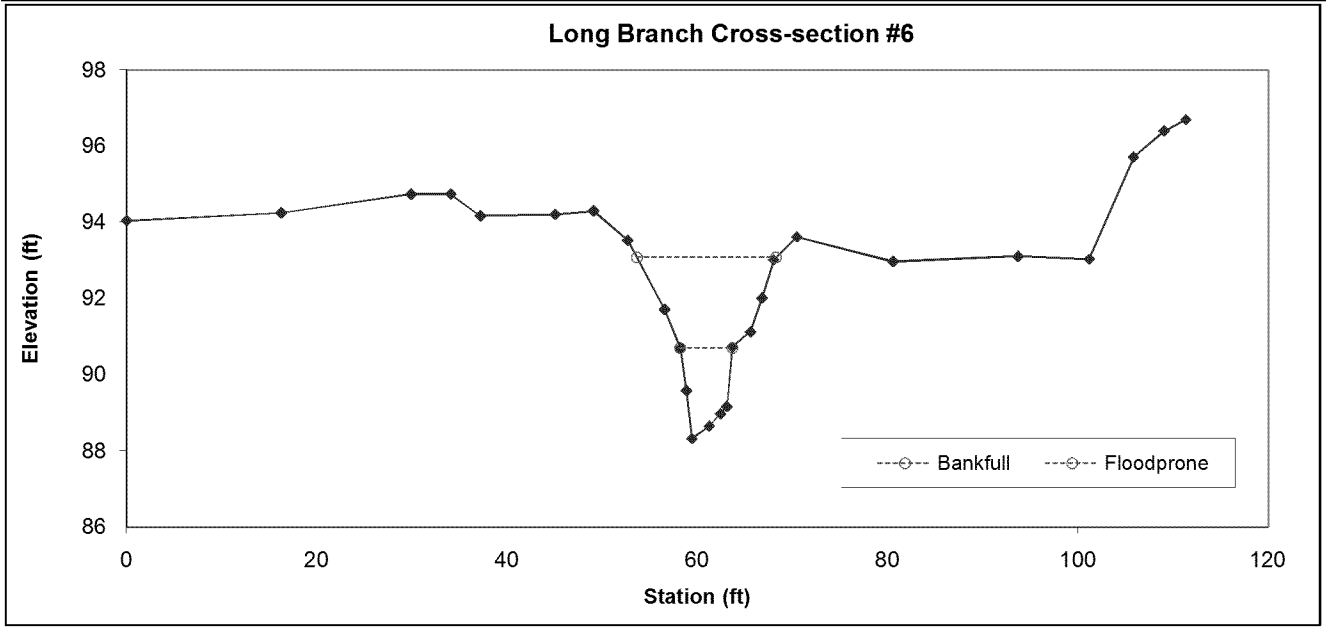
Cross-section #6

(collected June 2011)

Looking at the Left Bank

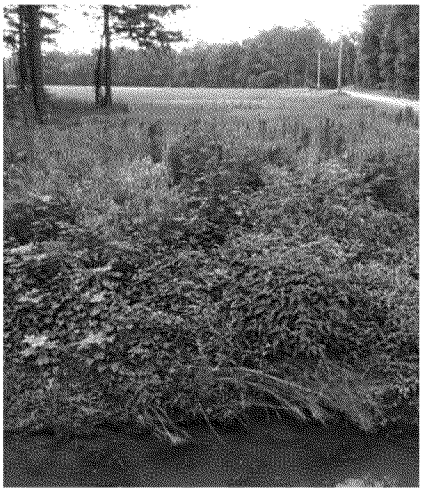
Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	9.2	5.49	1.67	2.38	3.28	2.2	2.7	90.7	93.61



Cross-section #7

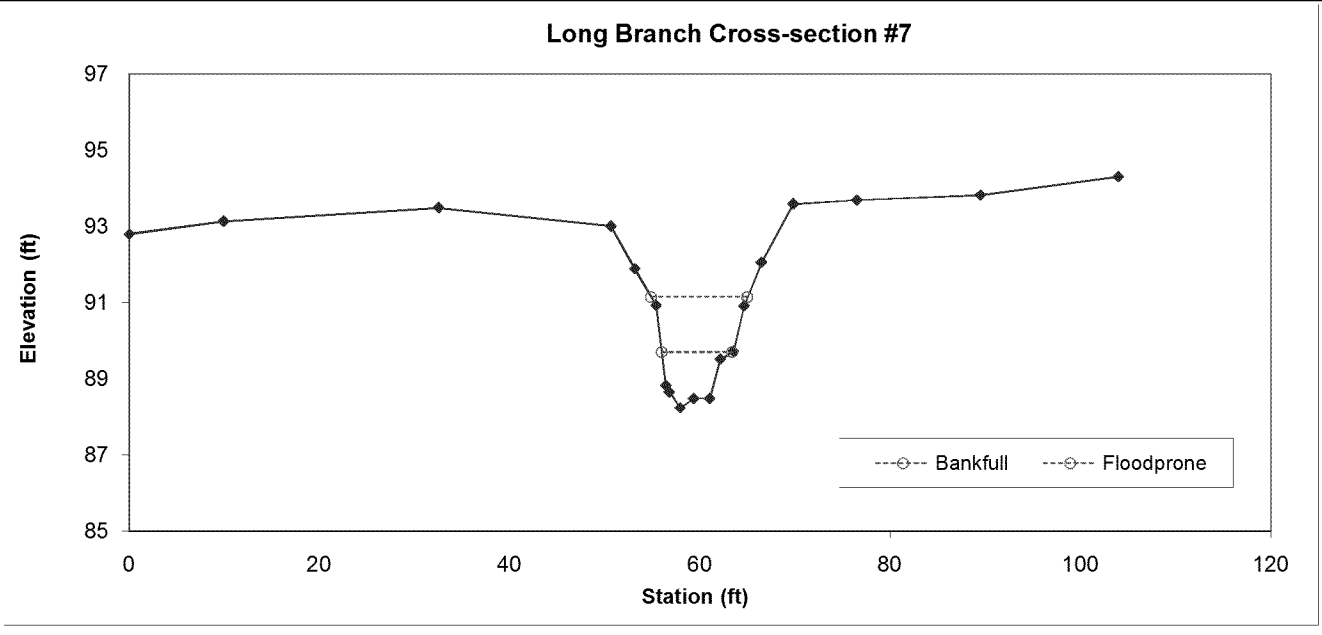
(collected June 2011)

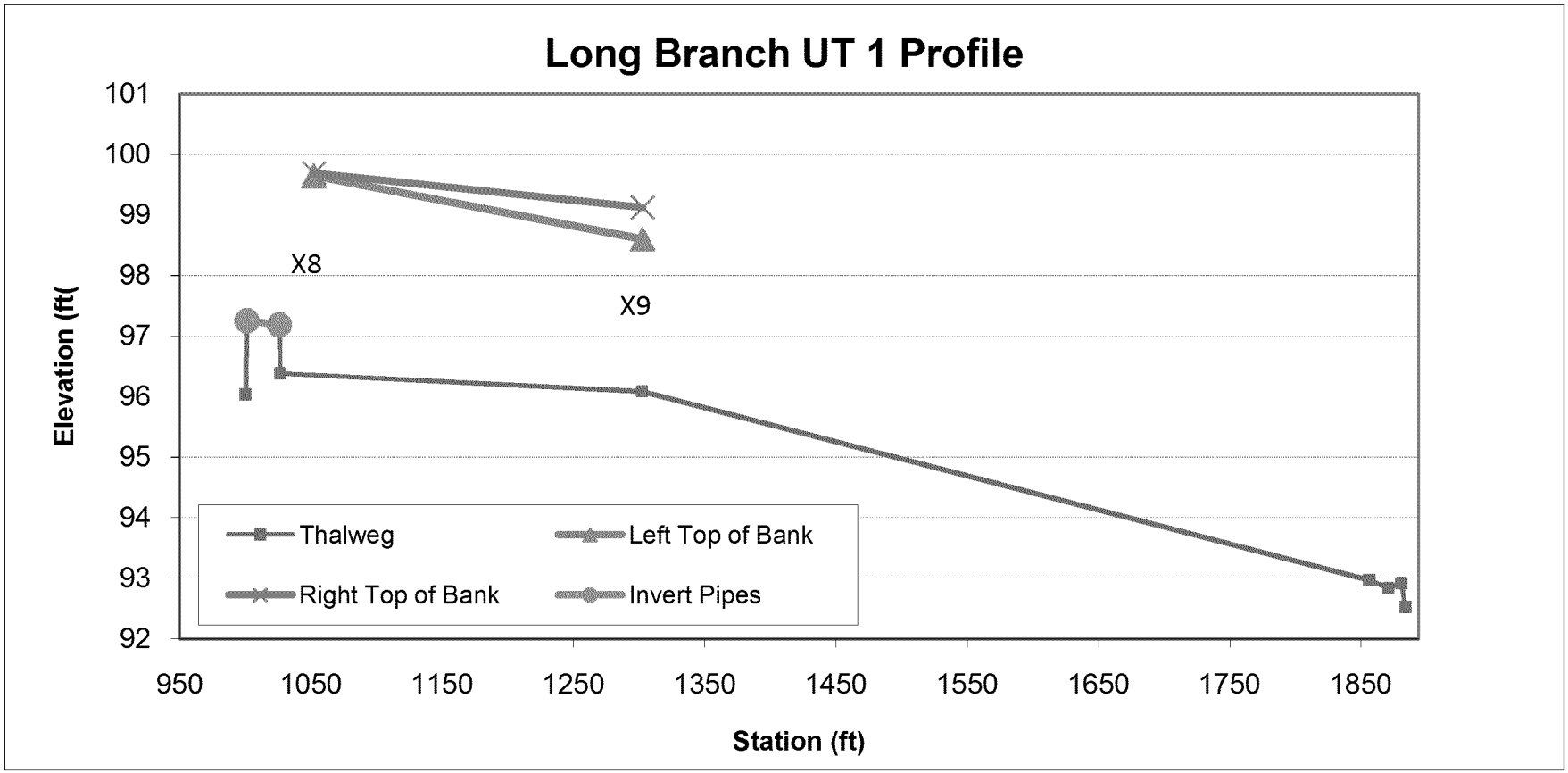


Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	G	6.8	7.38	0.92	1.45	8.05	3.3	1.4	89.7	93.01




Long Branch UT 1 Profile
Elevation (ft(
101
100
99
98
97
96
95
94
93
92
X8
X9
Thalweg
Left Top of Bank
Right Top of Bank
Invert Pipes
950
1050
1150
1250
1350
1450
1550
1650
1750
1850
Station (ft)

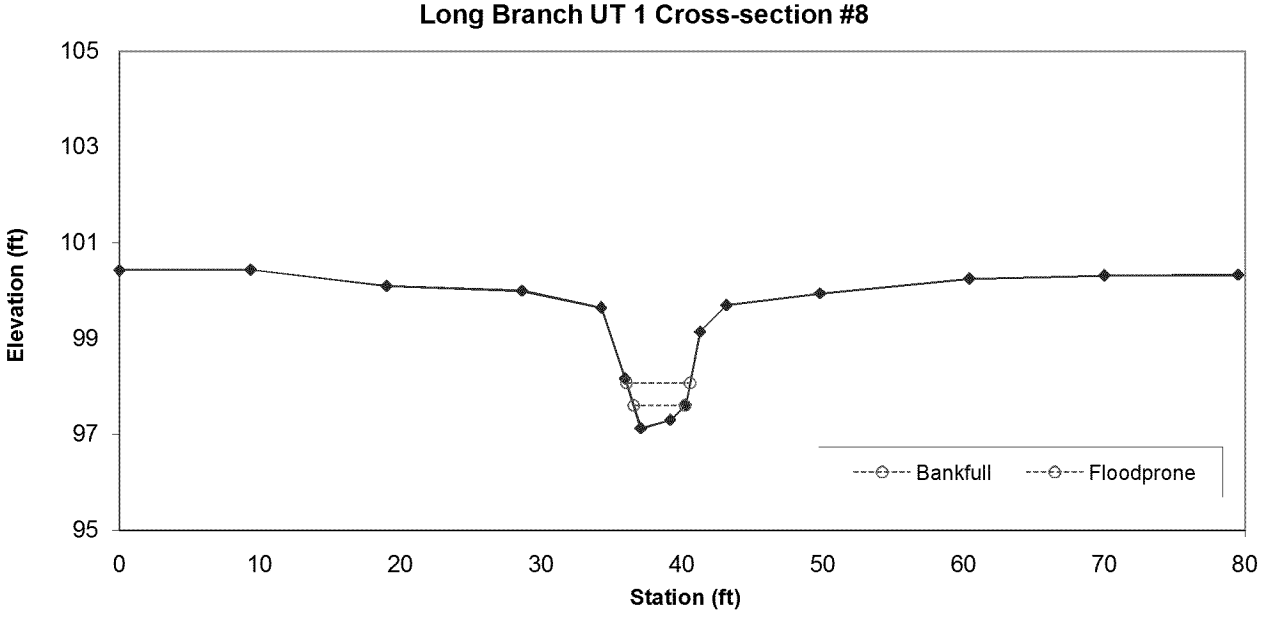
Cross-section #8

(collected June 2011)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	F	1.1	3.64	0.3	0.47	12.29	5.4	1.2	97.6	99.65



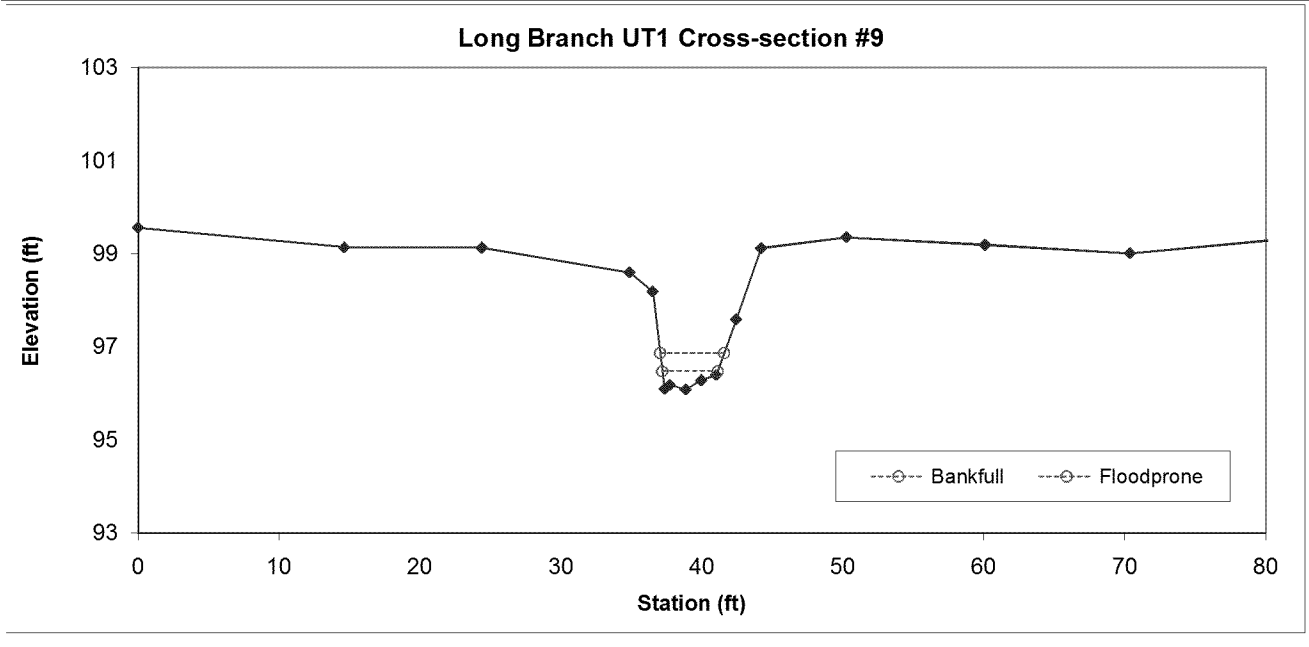
Cross-section #9

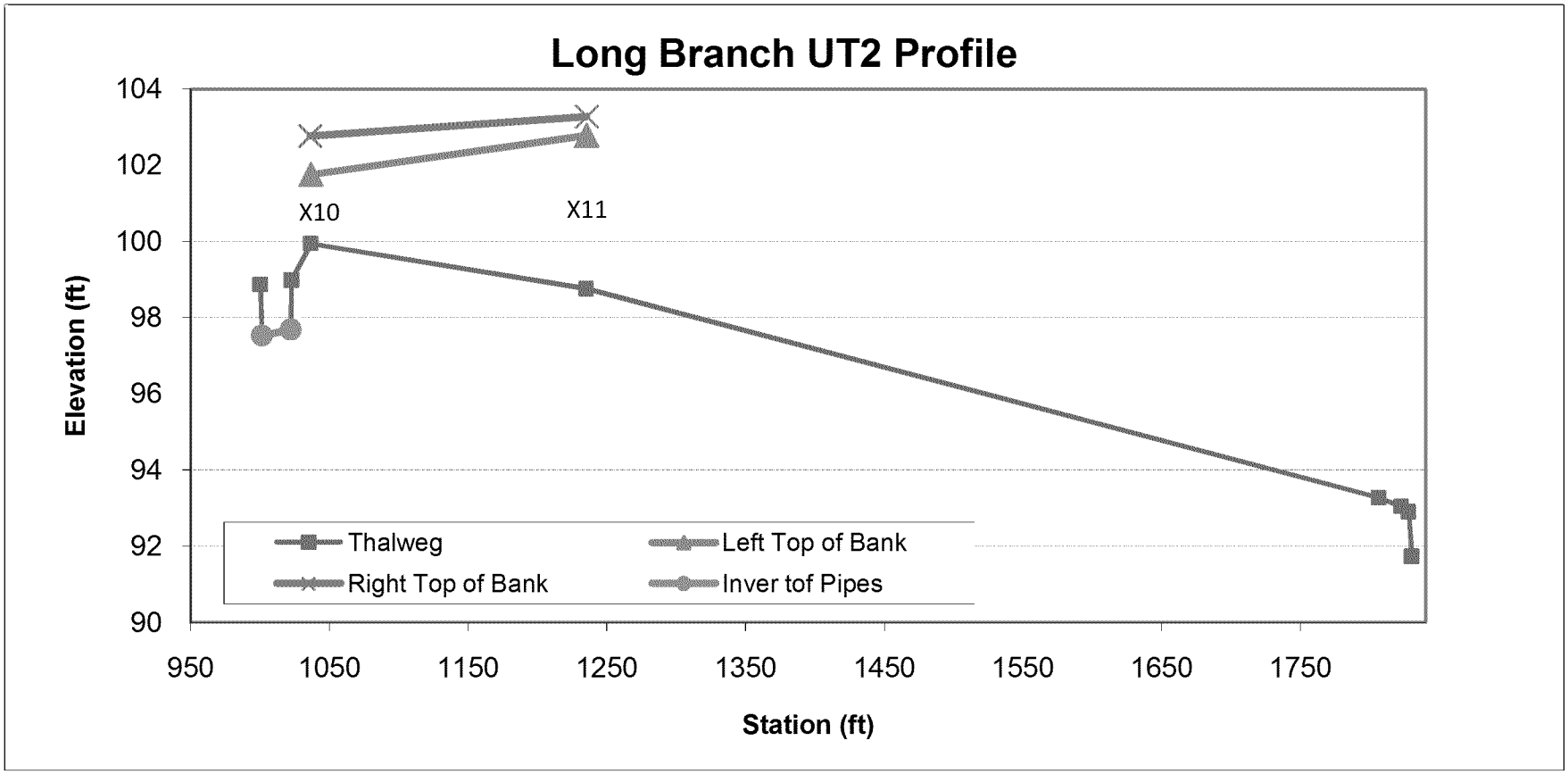
(collected June 2011)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	F	1	3.92	0.26	0.39	15.05	6.4	1.2	96.48	98.6

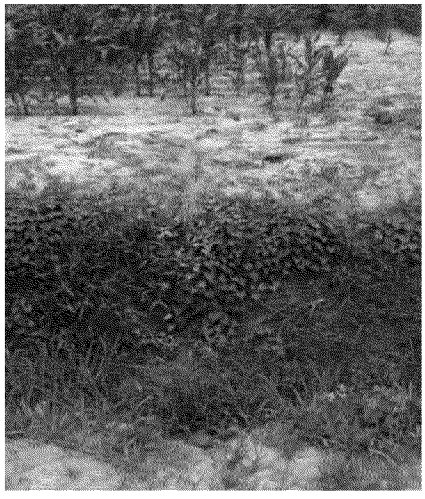



Long Branch UT2 Profile
104
102
100
98
96
94
92
90
Elevation (ft)
X10
X11
Thalweg
Left Top of Bank
Right Top of Bank
Inver tof Pipes
950
1050
1150
1250
1350
1450
1550
1650
1750
Station (ft)

Cross-section #10

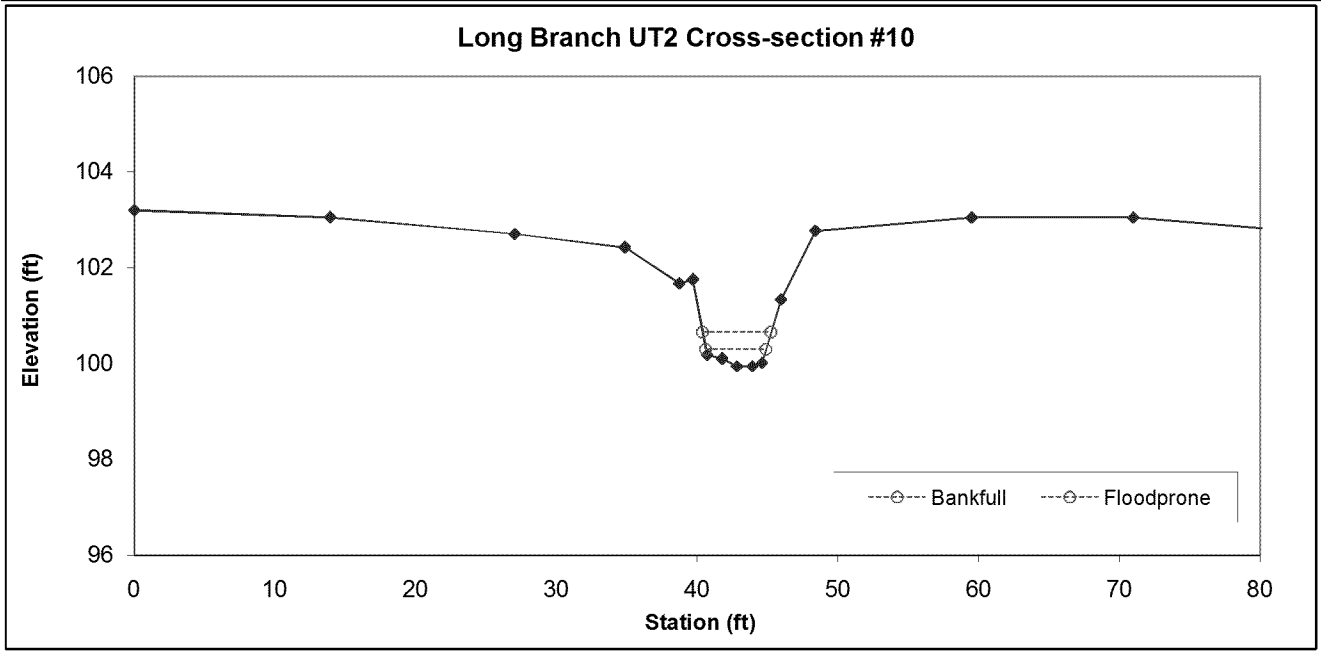
(collected June 2011)

Looking at the Left Bank



Looking at the Right Bank

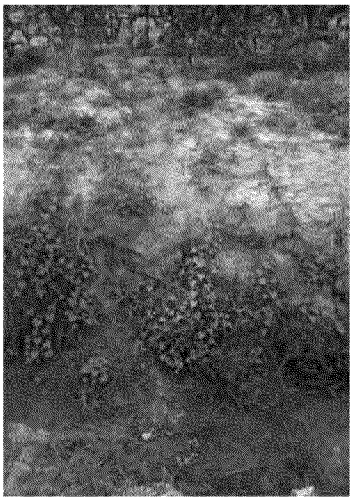
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	F	1.1	4.28	0.26	0.36	16.44	7	1.1	100.3	102.43



Cross-section #11

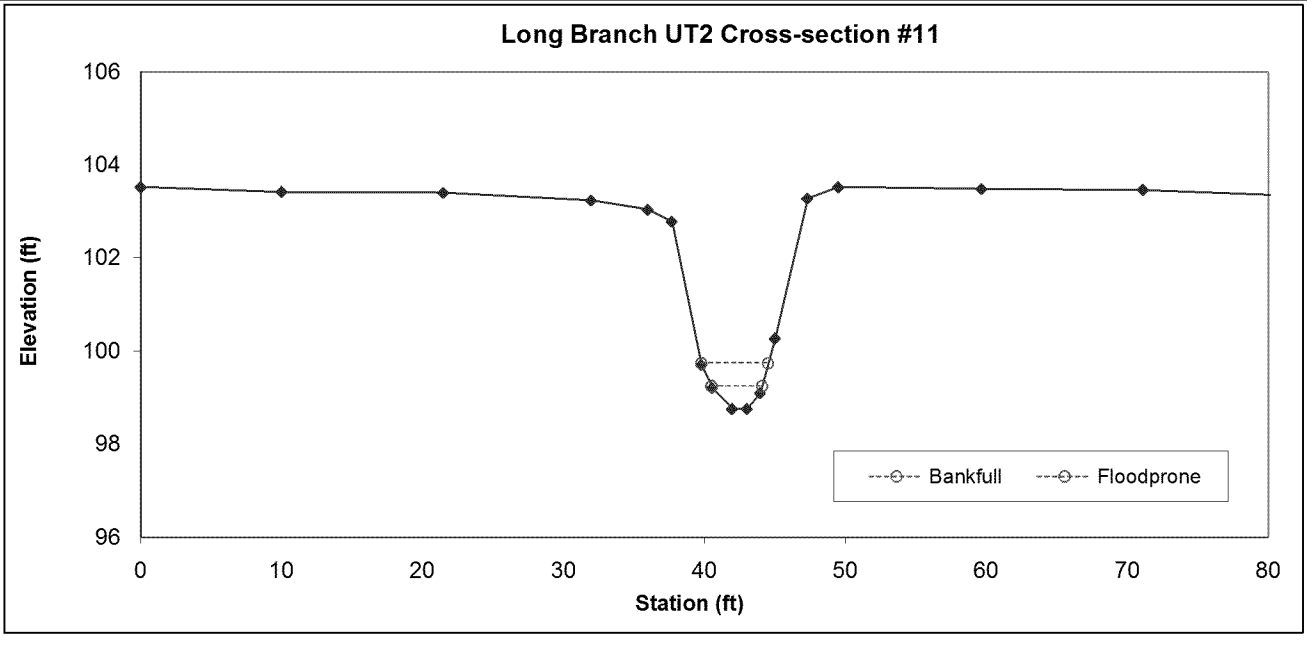
(collected June 2011)

Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Gc	1.2	3.59	0.33	0.49	10.79	8.2	1.3	99.25	102.79



APPENDIX 6

REPRESENATIVE PLANT SPECIES LIST LONG BRANCH MITIGATION SITE				
SCIENTIFIC NAME	**COMMON NAME**	**COMMUNITY TYPE**	**DOMINANT?**	**STRATA**
Acer rubrum	Red maple	Both	Yes	Canopy and sub-canopy
Alnus serrulata	Tag alder	Wetland	No	Shrub
Andropogon virginiana	Broomsedge	Both	Yes	Herbaceous
Arundinaria gigantea	Giant cane	Wetland	Yes	Herbaceous
Asplenium platyneuron	Ebony spleenwort	Upland	Yes	Herbaceous
Berchemia scandens	Supplejack	Wetland	No	Vine
Bignonia capreolata	Crossvine	Wetland	No	Vine
Boehmeria cylindrica	False nettle	Wetland	No	Herbaceous
Callicarpa americana	Beautyberry	Upland	No	Shrub
Carpinus caroliniana	American hornbeam	Both	No	Sub-canopy and shrub
Chimaphila maculata	Spotted wintergreen	Upland	No	herbaceous
Clethra alnifolia	Sweet pepperbush	Both	Yes	Shrub
Cyrilla racemiflora	Titi	Wetland	No	Shrub
Dichanthelium scoparium	Velvet panicum	Both	No	Herbaceous
Diospyros virginiana	Persimmon	Upland	No	Sub-canopy and shrub
Eupatorium capillifolium	Dog fennel	Both	Yes	Herbaceous

REPRESENATIVE PLANT SPECIES LIST LONG BRANCH MITIGATION SITE				
SCIENTIFIC NAME	**COMMON NAME**	**COMMUNITY TYPE**	**DOMINANT?**	**STRATA**
Gelsemium sempervirens	Sweet jessamine	Upland	No	Vine
Hexastylis arifolia	Common heartleaf	Upland	No	Herbaceous
Hypericum hypericoides	Saint Andrew's cross	Upland	No	Shrub
Ilex coriacea	Gallberry	Wetland	Yes	Shrub
Ilex glabra	Inkberry	Both	No	Shrub
Ilex opaca	American holly	Upland	Yes	Sub-canopy
Juncus effusus	Soft rush	Wetland	No	Herbaceous
Ligustrum sinense	Chinese privet	Upland	Yes	Shrub
Liquidambar styraciflua	Sweet gum	Both	Yes	Canopy and sub-canopy
Liriodendron tulipifera	Yellow poplar	Both	No	Canopy and Sub-canopy
Lonicera japonica	Japanese honeysuckle	Upland	No	Vine
Lyonia lucida	Fetterbush	Wetland	Yes	Shrub
Magnolia virginiana	Sweet bay	Wetland	Yes	Shrub
Mikania scandens	Climbing swamp hempvine	Wetlands	No	Herbaceous vine
Mitchella repens	Partridgeberry	Upland	No	Vine
Morella cerifera	Wax myrtle	Both	Yes	Shrub
Murdannia keisak	Asian spiderwort	Wetland	No	Herbaceous
Nuphar luteum	Spatterdock	Wetland	No	Herbaceous
Nyssa biflora	Swamp gum	Wetland	Yes	Canopy
Nyssa sylvatica	Black gum	Upland	No	Canopy and sub-canopy

REPRESENATIVE PLANT SPECIES LIST LONG BRANCH MITIGATION SITE				
SCIENTIFIC NAME	**COMMON NAME**	**COMMUNITY TYPE**	**DOMINANT?**	**STRATA**
Osmunda regalis	Royal fern	Wetland	No	Herbaceous
Osmundastrum cinnamomea	Cinnamon fern	Wetland	No	Herbaceous
Panicum anceps	Beaked panicgrass	Both	No	Herbaceous
Parthenocissus quinquefolia	Virginia creeper	Upland	No	Vine
Peltandra virginica	Arrow arum	Wetland	No	Herbaceous
Persea borbonia	Red bay	Wetland	Yes	Shrub
Pinus serotina	Pond pine	Wetland	No	Canopy and sub-canopy
Pinus taeda	Loblolly pine	Both	Yes	Canopy and sub-canopy
Prunus serotina	Black cherry	Upland	Yes	Canopy and sub-canopy
Pteridium aquilinum	Bracken fern	Both	Yes	Herbaceous
Quercus nigra	Water oak	Both	Yes	Canopy
Rhus copallinum	Winged sumac	Upland	No	Shrub
Rubus argutus	Blackberry	Both	Yes	Vine
Saccharium giganteum	Giant plume grass	Wetland	No	Herbaceous
Sambucus canadensis	Black elderberry	Wetland	No	Shrub
Scirpus cyperinus	Woolgrass	Wetland	No	Herbaceous
Smilax glauca	Catbrier	Upland	No	Vine
Smilax laurifolia	Bamboo vine	Wetland	Yes	Vine
Smilax rotundifolia	Greenbrier	Both	Yes	Vine
Symplocos tinctoria	Sweetleaf	Upland	Yes	Shrub

REPRESENATIVE PLANT SPECIES LIST LONG BRANCH MITIGATION SITE				
SCIENTIFIC NAME	**COMMON NAME**	**COMMUNITY TYPE**	**DOMINANT?**	**STRATA**
Toxicodendron radicans	Poison ivy	Upland	No	Vine
Vaccinium arboreum	Sparkleberry	Upland	Yes	Shrub
Vaccinium sp.	Wild blueberry	Both	No	Shrub
Verbena brasiliensis	Vervain	Upland	Yes	Herbaceous
Vitis rotundifolia	Muscadine	Both	Yes	Vine
Woodwardia areolata	Netted chain fern	Wetland	No	Herbaceous
Xyris spp.	Yellow-eyed grass	Wetland	No	Herbaceous

APPENDIX 7

Indian Pot Branch Reference Reach Photographs

Indian Pot Branch, Section I

Indian Pot Branch, Section I

Indian Pot Branch, Section I

APPENDIX 8

Determination of Stream Credits

Restoration Mitigation Factors and Worksheet

Working Draft, Subject to Change
Last Revised: June 24, 2011

Section A

Restoration Mitigation Factors For Linear Systems				
FACTORS	**OPTIONS**			
Stream Type [1]	Non-RPWs 0.05	1st and 2nd Order RPWs 0.4	All Other Streams 0.2	
Priority Category	Tertiary 0.05	Secondary 0.2	Primary 0.3	
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1] Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for Linear Systems						
FACTOR	**REACH 1**			**REACH 2**		
Credit Type	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only
Stream Type	1st & 2nd Order RPW			1st & 2nd Order RPW		
Priority Category	Tertiary			Tertiary		
Net Improvement	Significant			Significant		
Credit Schedule	Before			Before		
Location	Adjacent HUC			Adjacent HUC		
Riparian Buffer Side A	.3			.34		
Riparian Buffer Side B	.3			.34		
Sum of Mitigation Factors =	3.2			3.28		
Proposed Linear Feet of Stream =	592			1682		
Proposed Restoration (In-Stream work + Min Buffer) M_a x LL =	1894.4			5516.96		
Proposed Preservation (Stream Preservation or Buffers Only) M_b x LL =						

Total Proposed Stream Restoration Credits = **7411.36**

Total Proposed Buffer Credits =

When calculating credits, if a reach has in-stream work and additional buffers beyond minimum required, do not use grayed areas under additional stream buffers. If proposed work will be stream preservation or buffer enhancement ONLY, use Stream Preservation or buffers only column.

Determination of Stream Credits

Restoration Mitigation Factors and Worksheet

Working Draft, Subject to Change
Last Revised: June 24, 2011

Section B

Restoration Mitigation Factors For Linear Systems				
FACTORS	**OPTIONS**			
Stream Type [1]	Non-RPWs 0.05	1st and 2nd Order RPWs 0.4	All Other Streams 0.2	
Priority Category	Tertiary 0.05	Secondary 0.2	Primary 0.3	
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1] Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for Linear Systems						
FACTOR	**REACH 1**			**REACH 2**		
Credit Type	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only
Stream Type	1st & 2nd Order RPW					
Priority Category	Tertiary					
Net Improvement	Significant					
Credit Schedule	Before					
Location	Adjacent HUC					
Riparian Buffer Side A	.34					
Riparian Buffer Side B	.34					
Sum of Mitigation Factors =	3.28					
Proposed Linear Feet of Stream =	269					
Proposed Restoration (In-Stream work + Min Buffer) M_a x LL =	882.32					
Proposed Preservation (Stream Preservation or Buffers Only) M_b x LL =						

Total Proposed Stream Restoration Credits = **882.32**

Total Proposed Buffer Credits =

When calculating credits, if a reach has in-stream work and additional buffers beyond minimum required, do not use grayed areas under additional stream buffers. If proposed work will be stream preservation or buffer enhancement ONLY, use Stream Preservation or buffers only column.

Determination of Stream Credits

Restoration Mitigation Factors and Worksheet

Working Draft, Subject to Change
Last Revised: June 24, 2011

Section C

Restoration Mitigation Factors For Linear Systems				
FACTORS	**OPTIONS**			
Stream Type [1]	Non-RPWs 0.05	1st and 2nd Order RPWs 0.4	All Other Streams 0.2	
Priority Category	Tertiary 0.05	Secondary 0.2	Primary 0.3	
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1] Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for Linear Systems						
FACTOR	**REACH 1**			**REACH 2**		
Credit Type	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only
Stream Type			1st & 2nd Order RPW			
Priority Category			Tertiary			
Net Improvement						
Credit Schedule			Before			
Location			Adjacent HUC			
Riparian Buffer Side A			.2			
Riparian Buffer Side B			.22			
Sum of Mitigation Factors =			1.02			
Proposed Linear Feet of Stream =			988			
Proposed Restoration (In-Stream work + Min Buffer) M_a x LL =						
Proposed Preservation (Stream Preservation or Buffers Only) M_b x LL =			1007.76			

Total Proposed Stream Restoration Credits =

Total Proposed Buffer Credits = 1007.76

When calculating credits, if a reach has in-stream work and additional buffers beyond minimum required, do not use grayed areas under additional stream buffers. If proposed work will be stream preservation or buffer enhancement ONLY, use Stream Preservation or buffers only column.

Determination of Stream Credits

Restoration Mitigation Factors and Worksheet

Working Draft, Subject to Change
Last Revised: June 24, 2011

Section D

Restoration Mitigation Factors For Linear Systems				
FACTORS	**OPTIONS**			
Stream Type [1]	Non-RPWs 0.05	1st and 2nd Order RPWs 0.4	All Other Streams 0.2	
Priority Category	Tertiary 0.05	Secondary 0.2	Primary 0.3	
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1] Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for Linear Systems						
FACTOR	**REACH 1**			**REACH 2**		
Credit Type	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only
Stream Type			1st & 2nd Order RPW			
Priority Category			Tertiary			
Net Improvement						
Credit Schedule			Before			
Location			Adjacent HUC			
Riparian Buffer Side A			.34			
Riparian Buffer Side B			.34			
Sum of Mitigation Factors =			1.28			
Proposed Linear Feet of Stream =			2767			
Proposed Restoration (In-Stream work + Min Buffer) M_a x LL =						
Proposed Preservation (Stream Preservation or Buffers Only) M_b x LL =			3541.76			

Total Proposed Stream Restoration Credits =

Total Proposed Buffer Credits = 3541.76

When calculating credits, if a reach has in-stream work and additional buffers beyond minimum required, do not use grayed areas under additional stream buffers. If proposed work will be stream preservation or buffer enhancement ONLY, use Stream Preservation or buffers only column.

Determination of Stream Credits

Restoration Mitigation Factors and Worksheet

Working Draft, Subject to Change
Last Revised: June 24, 2011

Section E

Restoration Mitigation Factors For Linear Systems				
FACTORS	**OPTIONS**			
Stream Type [1]	Non-RPWs 0.05	1st and 2nd Order RPWs 0.4	All Other Streams 0.2	
Priority Category	Tertiary 0.05	Secondary 0.2	Primary 0.3	
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1] Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for Linear Systems						
FACTOR	**REACH 1**			**REACH 2**		
Credit Type	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only
Stream Type			1st & 2nd Order RPW			1st & 2nd Order RPW
Priority Category			Tertiary			Tertiary
Net Improvement						
Credit Schedule			Before			Before
Location			Adjacent HUC			Adjacent HUC
Riparian Buffer Side A			.22			.34
Riparian Buffer Side B						.34
Sum of Mitigation Factors =			0.82			1.28
Proposed Linear Feet of Stream =			793.5			294
Proposed Restoration (In-Stream work + Min Buffer) M_a x LL =						
Proposed Preservation (Stream Preservation or Buffers Only) M_b x LL =			650.67			376.32

Total Proposed Stream Restoration Credits =

Total Proposed Buffer Credits = **1026.99**

When calculating credits, if a reach has in-stream work and additional buffers beyond minimum required, do not use grayed areas under additional stream buffers. If proposed work will be stream preservation or buffer enhancement ONLY, use Stream Preservation or buffers only column.

Determination of Stream Credits

Restoration Mitigation Factors and Worksheet

Working Draft, Subject to Change
Last Revised: June 24, 2011

Section F

Restoration Mitigation Factors For Linear Systems				
FACTORS	**OPTIONS**			
Stream Type [1]	Non-RPWs 0.05	1st and 2nd Order RPWs 0.4	All Other Streams 0.2	
Priority Category	Tertiary 0.05	Secondary 0.2	Primary 0.3	
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1] Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for Linear Systems						
FACTOR	**REACH 1**			**REACH 2**		
Credit Type	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only
Stream Type			1st & 2nd Order RPW			
Priority Category			Tertiary			
Net Improvement						
Credit Schedule			Before			
Location			Adjacent HUC			
Riparian Buffer Side A			.22			
Riparian Buffer Side B						
Sum of Mitigation Factors =			0.82			
Proposed Linear Feet of Stream =			2506			
Proposed Restoration (In-Stream work + Min Buffer) M_a x LL =						
Proposed Preservation (Stream Preservation or Buffers Only) M_b x LL =			2054.92			

Total Proposed Stream Restoration Credits =

Total Proposed Buffer Credits = 2054.92

When calculating credits, if a reach has in-stream work and additional buffers beyond minimum required, do not use grayed areas under additional stream buffers. If proposed work will be stream preservation or buffer enhancement ONLY, use Stream Preservation or buffers only column.

Determination of Stream Credits

Restoration Mitigation Factors and Worksheet

Working Draft, Subject to Change
Last Revised: June 24, 2011

Section G

Restoration Mitigation Factors For Linear Systems				
FACTORS	**OPTIONS**			
Stream Type [1]	Non-RPWs 0.05	1st and 2nd Order RPWs 0.4	All Other Streams 0.2	
Priority Category	Tertiary 0.05	Secondary 0.2	Primary 0.3	
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1] Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for Linear Systems						
FACTOR	**REACH 1**			**REACH 2**		
Credit Type	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only
Stream Type	1st & 2nd Order RPW			1st & 2nd Order RPW		
Priority Category	Tertiary			Tertiary		
Net Improvement	Significant			Significant		
Credit Schedule	Before			Before		
Location	Adjacent HUC			Adjacent HUC		
Riparian Buffer Side A	.34			0		
Riparian Buffer Side B	.34			0		
Sum of Mitigation Factors =	3.28			2.6		
Proposed Linear Feet of Stream =	1118			150		
Proposed Restoration (In-Stream work + Min Buffer) M_a x LL =	3667.04			390		
Proposed Preservation (Stream Preservation or Buffers Only) M_b x LL =						

Total Proposed Stream Restoration Credits = 4057.04

Total Proposed Buffer Credits =

When calculating credits, if a reach has in-stream work and additional buffers beyond minimum required, do not use grayed areas under additional stream buffers. If proposed work will be stream preservation or buffer enhancement ONLY, use Stream Preservation or buffers only column.

Determination of Stream Credits

Restoration Mitigation Factors and Worksheet

Working Draft, Subject to Change
Last Revised: June 24, 2011

Section H

Restoration Mitigation Factors For Linear Systems				
FACTORS	**OPTIONS**			
Stream Type [1]	Non-RPWs 0.05	1st and 2nd Order RPWs 0.4	All Other Streams 0.2	
Priority Category	Tertiary 0.05	Secondary 0.2	Primary 0.3	
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1] Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for Linear Systems						
FACTOR	**REACH 1**			**REACH 2**		
Credit Type	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only
Stream Type	1st & 2nd Order RPW			1st & 2nd Order RPW		
Priority Category	Tertiary			Tertiary		
Net Improvement	Significant			Significant		
Credit Schedule	Before			Before		
Location	Adjacent HUC			Adjacent HUC		
Riparian Buffer Side A	.22			0		
Riparian Buffer Side B	0			0		
Sum of Mitigation Factors =	2.82			2.6		
Proposed Linear Feet of Stream =	214			150		
Proposed Restoration (In-Stream work + Min Buffer) M_a x LL =	603.48			390		
Proposed Preservation (Stream Preservation or Buffers Only) M_b x LL =						

Total Proposed Stream Restoration Credits = 993.48

Total Proposed Buffer Credits =

When calculating credits, if a reach has in-stream work and additional buffers beyond minimum required, do not use grayed areas under additional stream buffers. If proposed work will be stream preservation or buffer enhancement ONLY, use Stream Preservation or buffers only column.

Determination of Stream Credits

Restoration Mitigation Factors and Worksheet

Working Draft, Subject to Change
Last Revised: June 24, 2011

Section I

Restoration Mitigation Factors For Linear Systems				
FACTORS	**OPTIONS**			
Stream Type [1]	Non-RPWs 0.05	1st and 2nd Order RPWs 0.4	All Other Streams 0.2	
Priority Category	Tertiary 0.05	Secondary 0.2	Primary 0.3	
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1] Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for Linear Systems						
FACTOR	**REACH 1**			**REACH 2**		
Credit Type	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only	In-Stream work with Minimum Buffer	Additional Stream Buffers	Stream Preservation or Buffers Only
Stream Type			1st & 2nd Order RPW			1st & 2nd Order RPW
Priority Category			Tertiary			Tertiary
Net Improvement						
Credit Schedule			Before			Before
Location			Adjacent HUC			Adjacent HUC
Riparian Buffer Side A			.22			.34
Riparian Buffer Side B			0			.34
Sum of Mitigation Factors =			0.82			1.28
Proposed Linear Feet of Stream =			1060			2000
Proposed Restoration (In-Stream work + Min Buffer) M_a x LL =						
Proposed Preservation (Stream Preservation or Buffers Only) M_b x LL =			869.2			2560

Total Proposed Stream Restoration Credits =

Total Proposed Buffer Credits = 3429.2

When calculating credits, if a reach has in-stream work and additional buffers beyond minimum required, do not use grayed areas under additional stream buffers. If proposed work will be stream preservation or buffer enhancement ONLY, use Stream Preservation or buffers only column.

Determination of Stream Credits

Linear Systems

Working Draft, Subject to Change
Last Revised: October 7, 2010

Mitigation Summary Worksheet For Permit Application # 2008-1333-DIS

I. Required Mitigation	Credits	Linear Feet (Impact)
A. Required Mitigation Credits Calculated from Worksheet	22640	**4643**
B. Reduction Credit: Has the permittee protected the remaining on-site aquaticresources? Are the remaining on-site aquatic resources at least 3x the proposed LF of impacted resources? *(If you answer yes to both questions, you may reduce the required credits under Section I (A) by 25%)*	◉ NO ○ YES 0	**Linear Feet (Preservation)**
C. Total Required Mitigation Credits = A - B	**22640**	**NO**

II. Permittee Responsible Mitigation Credit Summary	Credits	Linear Feet
D. Riparian Buffer Preservation / Enhancement	11060.63	10432
E. Stream Restoration / Enhancement / Improvement	13344.2	4175
F. Total Proposed Bank Mitigation = D + E	**24404.83**	**14607**

III. Third Party Mitigation Credit Summary	Credits	Linear Feet
G. Riparian Buffer Preservation / Enhancement		
H. Stream Restoration / Enhancement / Improvement		
I. Total Proposed Non-Bank Mitigation = G + H		

IV. Proposed Mitigation Summary	Credits	Linear Feet
J. Total Riparian Buffer Mitigation = D + G	**11060.63**	**10432**
K. Total Stream Restoration Mitigation = E + H	**13344.2**	**4175**
L. Total Proposed Mitigation = F + I	**24404.83**	**14607**

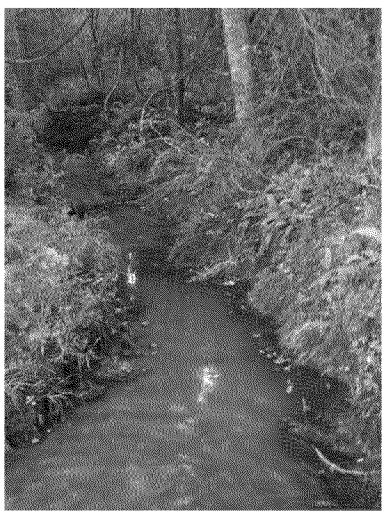
V. Local Compensatory Mitigation Goals Proposed Mitigation Credits (PMC) must be Greater than or equal to the Required Mitigation Credits (RMC)	Yes	No
PMC ≥ RMC - or in words - Are the Credits in Row L greater than or equal to Row C?	YES	
PMC Restoration and/or Enhancement ≥ ½ RMC - or in words - Are the Credits in Row J greater than or equal to 50% of Row C?		NO

APPENDIX 9

Long Branch Mitigation Site Existing Conditions Photographic Log

Long Branch, Section A, looking upstream

Long Branch, Section A, looking downstream on adjacent farm road



Long Branch, Section C, south of Stubbs Drive

Long Branch, Section C, just south of Bermuda Road

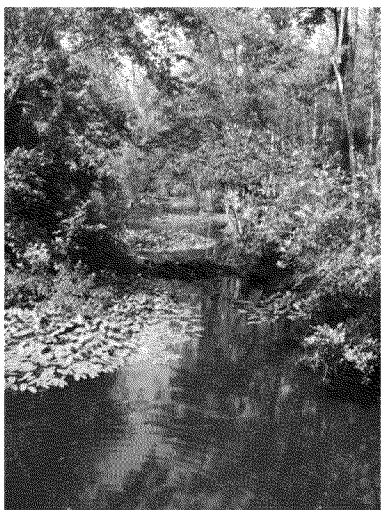
Long Branch, Section C, south of Bermuda Road. Note privet on the top of bank

Long Branch, lower portion of Section C

Indian Pot Branch, Section I

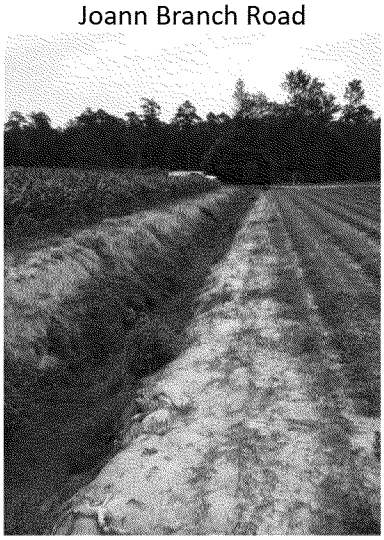
Indian Pot Branch, Section I

Indian Pot Branch, Section F, wetlands adjacent to Indian Pot Branch



Indian Pot Branch, Section F, looking north from Joann Branch Road

UT1, Section G, looking downstream towards confluence with Long Branch



UT2, Section H, looking upstream

APPENDIX 10

REFERENCES

Henry, Gary V., 1989. Guidelines for Preparation of Biological Assessments and Evaluations for the Red-Cockaded Woodpecker (Washington, DC: U.S. Fish & Wildlife Service Southeast Region, 1989).

Nelson, John B. 1986. South Carolina Wildlife and Marine Resources Department Division of Wildlife and Freshwater Fisheries, *The Natural Communities of South Carolina: Initial Classification and Description*, 1986.

Rosgen, D. L., 1996. "Applied River Morphology", Wildland Hydrology Books, 1481 Stevens Lake Road, Pagosa Springs, Co. 81147, 385 pp.

South Carolina Department of Natural Resources, 2006. Bald Eagle Wildlife Conservation Plan Wildlife Conservation Plan website, accessed June 8, 2012: http://www.dnr.sc.gov/cwcs/pdf/Baldeagle.pdf .

US Army Corps of Engineers Environmental Laboratory. 1987. US Army Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1. US Army Corps of Engineers Waterways Experiment Station, Vicksburg, MI.

US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, 1998. Final Recovery Plan for the Shortnose Sturgeon *(Acipenser brevirostrum)* (Washington, DC: National Marine Fisheries Service, 1998)., website accessed June 8, 2012: http://www.nmfs.noaa.gov/pr/pdfs/recovery/sturgeon_shortnose.pdf.

US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, 2012. Protected Resources Summary, Atlantic Sturgeon *(Acipenser oxyrinchus oxyrinchus)* (Washington, DC: National Marine Fisheries Service, 2012)., website accessed June 8, 2012: http://www.nmfs.noaa.gov/pr/species/fish/atlanticsturgeon.htm